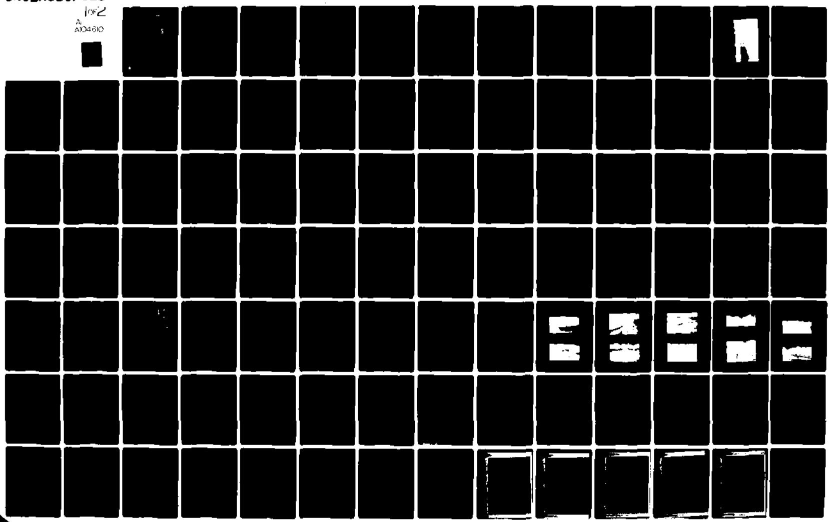
AD-A104 610 PRC CONSOER TOWNSEND INC ST LOUIS MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. CARL DREYER LAKE DAM (MO 10158), M--ETC(U)
SEP 80 W G SHIFRIN DACW43-80-C-0094

UNCLASSIFIED NL

1 OF 2
AD A104610



LEVEL II

AD A104610

MISSOURI · KANSAS CITY RIVER BASIN

CARL DREYER LAKE DAM
MONTGOMERY COUNTY, MISSOURI
MO. 10158

DTIC
ELECTE
SEP 28 1981
S E D

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

DTIC FILE COPY

PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

81 9 28 121

SEPTEMBER, 1980

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

12 133

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A104610	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Carl Dreyer Lake Dam (MO 10158) Montgomery County, Missouri		5. TYPE OF REPORT & PERIOD COVERED 9 Final Report.
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Consoer, Townsend and Associates, Ltd.		8. CONTRACT OR GRANT NUMBER(s) 15 DACW43-80-C-0094
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 11
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101		12. REPORT DATE Sep[redacted]80
		13. NUMBER OF PAGES Approximately 125
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) 6 National Dam Safety Program. Carl Dreyer Lake Dam (MO 10158) Missouri-Kansas City River Basin, Montgomery County, Missouri. Phase I Inspection Report.		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for release; distribution unlimited.

10 Walter G. Shifrin

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition [illegible] respect to safety, based on available data and on visual [illegible] determine if the dam poses hazards to human life or [illegible]

DD FORM 1473 1 JAN 73 EDITION OF 1 NOV 65 IS OBSOLETE 411

SECURITY CLASSIFICATION OF THIS PAGE

INSTRUCTIONS FOR PREPARATION OF REPORT DOCUMENTATION PAGE

RESPONSIBILITY. The controlling DoD office will be responsible for completion of the Report Documentation Page, DD Form 1473, in all technical reports prepared by or for DoD organizations.

CLASSIFICATION. Since this Report Documentation Page, DD Form 1473, is used in preparing announcements, bibliographies, and data banks, it should be unclassified if possible. If a classification is required, identify the classified items on the page by the appropriate symbol.

COMPLETION GUIDE

General. Make Blocks 1, 4, 5, 6, 7, 11, 13, 15, and 16 agree with the corresponding information on the report cover. Leave Blocks 2 and 3 blank.

Block 1. Report Number. *Enter the unique alphanumeric report number shown on the cover.*

Block 2. Government Accession No. Leave Blank. This space is for use by the Defense Documentation Center.

Block 3. Recipient's Catalog Number. Leave blank. This space is for the use of the report recipient to assist in future retrieval of the document.

Block 4. Title and Subtitle. Enter the title in all capital letters *exactly as it appears on the publication.* Titles should be unclassified whenever possible. Write out the English equivalent for Greek letters and mathematical symbols in the title *(see "Abstracting Scientific and Technical Reports of Defense-sponsored RDT/E,"AD-667 000).* If the report has a subtitle, this subtitle should follow the main title, be separated by a comma or semicolon if appropriate, and be initially capitalized. If a publication has a title in a foreign language, translate the title into English and follow the English translation with the title in the original language. Make every effort to simplify the title before publication.

Block 5. Type of Report and Period Covered. Indicate here whether report is interim, final, etc., and, if applicable, inclusive dates of period covered, such as the life of a contract covered in a final contractor report.

Block 6. Performing Organization Report Number. Only numbers other than the official report number shown in Block 1, such as series numbers for in-house reports or a contractor/grantee number assigned by him, will be placed in this space. If no such numbers are used, leave this space blank.

Block 7. Author*(s)*. Include corresponding information from the report cover. Give the name*(s)* of the author*(s)* in conventional order *(for example, John R. Doe or, if author prefers, J. Robert Doe).* In addition, list the affiliation of an author if it differs from that of the performing organization.

Block 8. Contract or Grant Number*(s)*. For a contractor or grantee report, enter the complete contract or grant number*(s)* under which the work reported was accomplished. Leave blank in in-house reports.

Block 9. Performing Organization Name and Address. For in-house reports enter the name and address, including office symbol, of the performing activity. For contractor or grantee reports enter the name and address of the contractor or grantee who prepared the report and identify the appropriate corporate division, school, laboratory, etc., of the author. List city, state, and ZIP Code.

Block 10. Program Element, Project, Task Area, and Work Unit Numbers. Enter here the number code from the applicable Department of Defense form, such as the DD Form 1498, "Research and Technology Work Unit Summary" or the DD Form 1634. "Research and Development Planning Summary," which identifies the program element, project, task area, and work unit or equivalent under which the work was authorized.

Block 11. Controlling Office Name and Address. Enter the full, official name and address, including office symbol, of the controlling office. *(Equates to funding/sponsoring agency. For definition see DoD Directive 5200.20, "Distribution Statements on Technical Documents.")*

Block 12. Report Date. Enter here the day, month, and year or month and year as shown on the cover.

Block 13. Number of Pages. *Enter the total number of pages.*

Block 14. Monitoring Agency Name and Address *(if different from Controlling Office).* For use when the controlling or funding office does not directly administer a project, contract, or grant, but delegates the administrative responsibility to another organization.

Blocks 15 & 15a. Security Classification of the Report: Declassification/Downgrading Schedule of the Report. Enter in 15 the highest classification of the report. If appropriate, enter in 15a the declassification/downgrading schedule of the report, using the abbreviations for declassification/downgrading schedules listed in paragraph 4-207 of DoD 5200.1-R.

Block 16. Distribution Statement of the Report. Insert here the applicable distribution statement of the report from DoD Directive 5200.20, "Distribution Statements on Technical Documents."

Block 17. Distribution Statement *(of the abstract entered in Block 20, if different from the distribution statement of the report).* Insert here the applicable distribution statement of the abstract from DoD Directive 5200.20, "Distribution Statements on Technical Documents."

Block 18. Supplementary Notes. Enter information not included elsewhere but useful, such as: Prepared in cooperation with . . . Translation of *(or by)* . . . Presented at conference of . . . To be published in . . .

Block 19. Key Words. Select terms or short phrases that identify the principal subjects covered in the report, and are sufficiently specific and precise to be used as index entries for cataloging, conforming to standard terminology. The DoD "Thesaurus of Engineering and Scientific Terms" *(TEST)*, AD-672 000, can be helpful.

Block 20. Abstract. The abstract should be a brief *(not to exceed 200 words)* factual summary of the most significant information contained in the report. If possible, the abstract of a classified report should be unclassified and the abstract to an unclassified report should consist of publicly- releasable information. If the report contains a significant bibliography or literature survey, mention it here. For information on preparing abstracts see "Abstracting Scientific and Technical Reports of Defense-Sponsored RDT&E," AD-667 000.

☆ U.S. G.P.O. 1980-665-141/1299

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO
ATTENTION OF

SUBJECT: Carl Dreyer Lake Dam (Mo. 10158) Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Carl Dreyer Lake Dam (Mo. 10158).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood
2) Overtopping could result in dam failure
3) Dam failure significantly increases the hazard to loss of life downstream

SUBMITTED BY: SIGNED — Chief, Engineering Division — 07 OCT 1980 Date

APPROVED BY: SIGNED — Colonel, CE, District Engineer — 08 OCT 1980 Date

Accession For	
NTIS GRA&I	☒
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A	

CARL DREYER LAKE DAM

MONTGOMERY COUNTY, MISSOURI

MISSOURI INVENTORY NO. 10158

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY

CONSOER, TOWNSEND AND ASSOCIATES, LTD.

ST. LOUIS, MISSOURI

AND

PRC ENGINEERING CONSULTANTS, INC.

ENGLEWOOD, COLORADO

A JOINT VENTURE

UNDER DIRECTION OF

ST. LOUIS DISTRICT, CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

SEPTEMBER 1980

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Carl Dreyer Lake Dam, Missouri Inv. No. 10158
State Located:	Missouri
County Located:	Montgomery
Stream:	An unnamed tributary of the Smith Branch of Clear Fork Creek
Date of Inspection:	June 5, 1980

Assessment of General Condition

Carl Dreyer Lake Dam was inspected by the engineering firms of Consoer, Townsend and Associates, Ltd. and PRC Engineering Consultants, Inc. (A Joint Venture) of St. Louis, Missouri according to the U. S. Army Corps of Engineers "Engineer Regulation No. 1110-2-106" and additional guidelines furnished by the St. Louis District of the Corps of Engineers. Based upon the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property damage could occur in the event of failure of the dam. There are four dwellings and two buildings within the estimated damage zone of four miles downstream of the dam, all of which may be subjected to flooding, with possible damage and/or destruction, and possible loss of life. Carl Dreyer Lake Dam is in the small size classification since it is less than 40 feet in height and impounds less than 1,000 acre-feet of water.

Our inspection and evaluation indicates that the reservoir/spillway system of Carl Dreyer Lake Dam does not meet the criteria set forth in the guidelines for a dam having the above size and

hazard potential. Carl Dreyer Lake Dam being a small size dam with a high hazard potential is required by the guidelines to be able to pass from one-half of the Probable Maximum Flood to the Probable Maximum Flood without overtopping the dam. Considering, however, the number of inhabited dwellings located downstream of the dam, the PMF is considered the appropriate spillway design flood for Carl Dreyer Lake Dam. It was determined that the reservoir/spillway system can accommodate approximately 20 percent of the Probable Maximum Flood before overtopping of the dam occurs. Our evaluation also indicates that the reservoir/spillway system will accommodate the one-percent chance flood (100-year flood) without overtopping the dam.

The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region.

Carl Dreyer Lake Dam and its appurtenant structures are in fair condition. Some deficiencies were noted by the inspection team, which could affect the safety of the dam and appurtenant structures. These items are as follows: the area of possible seepage to the left of the principal spillway pipe outlet, the small trees growing on the downstream slope, the wave erosion on the upstream slope, the erosion downstream of the toe of dam, the unmaintained vegetation on the embankment (especially on the downstream slope), the sloughed area in the emergency spillway, the rusting of the principal spillway pipe, the unknown location of the livestock watering system, a need for periodic inspection by a qualified engineer, and a lack of maintenance schedule. The lack of seepage and stability analyses on record is also a deficiency that should be corrected.

It is recommended that the owner take immediate action to correct the inadequacy of the reservoir/spillway system to pass the Probable Maximum Flood. Remedial measures should also be taken to correct or to control the other deficiencies described above in the near future.

Walter G. Shifrin, P.E.

STATE OF MISSOURI
WALTER
G. SHIFRIN
NUMBER
E-8834
REGISTERED PROFESSIONAL ENGINEER

Overview of Carl Dreyer Lake Dam

NATIONAL DAM SAFETY PROGRAM

CARL DREYER LAKE DAM, I.D. No. 10158

TABLE OF CONTENTS

TABLE OF CONTENTS

(Continued)

TABLE OF CONTENTS
(Continued)

LIST OF PLATES

APPENDICES

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

CARL DREYER LAKE DAM, Missouri Inv. No. 10158

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for Carl Dreyer Lake Dam was carried out under Contract DACW 43-80-C-0094 between the Department of the Army, St. Louis District, Corps of Engineers, and the engineering firms of Consoer, Townsend & Associates, Ltd., and PRC Engineering Consultants, Inc. (A Joint Venture), of St. Louis, Missouri.

b. Purpose of Inspection

The visual inspection of Carl Dreyer Lake Dam was made on June 5, 1980. The purpose of the inspection was to make a general assessment regarding the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project, provides a summary of visual observations made during the field inspection, gives an assessment of hydrologic and hydraulic conditions at the site, presents an evaluation of the structural adequacy of the various project features and appraises the general condition of the dam with respect to safety.

Subsurface investigations, laboratory testing and detailed analyses were not within the scope of this study. No warranty as to the absolute safety of the project features is implied by the conclusions presented in this report.

It should be noted in this report that reference to the left or right abutments is viewed as looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to the east abutment or side, and right to the west abutment or side.

d. Evaluation Criteria

The inspection and evaluation of the dam is performed in accordance with the U.S. Army Corps of Engineers "Engineer Regulation No. 1110-2-106" and additional guidelines furnished by the St. Louis District office of the Corps of Engineers for Phase 1 Dam Inspections.

1.2 Description of the Project

a. Description of Dam and Appurtenances

The following description is based upon observations and measurements made during the visual inspection and conversations with Mr. Bill Dreyer, the owner's representative. Two Soil Conservation Service (S.C.S.) design drawings were located and are pre-

sented in this report (see Plates 4 and 5). Discrepancies between our field notes and the design drawings were found and are noted in Section 2.1.

The dam is a homogeneous, rolled, earthfill structure between earth abutments, and consists of two straight portions of embankment angled at approximately 32 degrees to each other. A plan and elevation of the dam are shown on Plate 2 and Photos 1 through 3 show views of the dam. The major portion of the embankment has a bearing of approximately N 67° E and an axis length of 344 feet between the right abutment and the point of intersection of the two axes. The other portion of the dam has a bearing of approximately N 35° E and a length of 146 feet between the point of intersection of the two axes and the emergency spillway. The top of dam has a total length of 490 feet between the emergency spillway and the right abutment. The change in the alignment of the dam agrees with the design drawing. The top of dam is 15 feet wide and was measured as level with an elevation of 808.5 feet above mean sea level (M.S.L.). The maximum structural height of the dam was measured as 34 feet. The upstream slope above the water surface varied between 1 vertical to 2.5 horizontal (1V to 2.5H). The downstream slope was measured to be 1V to 1.75H. According to Mr. Dreyer, a core trench was constructed parallel to the dam axis, which agrees with the design drawings.

The dam was constructed with a double spillway scheme; the first is considered the principal spillway and operates as a closed conduit when flowing full, and the second is considered the emergency spillway and operates as an open channel.

The principal spillway was constructed from approximately 110 feet of welded steel pipe with a 5/16-inch wall thickness and 19-inch inside diameter. The inlet end of the pipe has been cut on an angle of approximately 35 degrees leaving the top of the pipe protruding over the bottom; also, there is a 30-inch diameter metal hood welded to the top of the inlet pipe (see Photo 5). It was laid

through the embankment, 292 feet to the right of the emergency spillway, on an approximately 30 percent slope. The entrance allows flow directly into the pipe. The principal spillway crest elevation is an assumed 804 feet above M.S.L. Water flowing over the crest to the outlet end of the spillway pipe enters a discharge pool before reaching the downstream channel (see Photo 6). According to the drawings received by the inspection team, two 6-foot by 6-foot metal cut off collars were installed during construction, and the pipe that was used for the spillway conduit was bituminous coated.

The emergency spillway was constructed into the left abutment area of the dam with a discharge channel that directs the excess flows in a perpendicular direction away from the dam; after flowing past the crest, the water enters a wide swale type channel before being directed into a wooded area (see Photo 7). The overflow eventually reaches the downstream channel. The emergency spillway crest operates as a trapezoidal open channel with a top width of 58 feet, a bottom width of 29 feet, and side slopes of approximately 1V to 8H. The slope of the approach to the emergency spillway crest is 14 percent, the crest itself is level for a distance 30 feet, and the discharge channel begins with a slope of approximately 1 percent which then steepens to a slope of almost 3 percent (see Plate 3). The elevation of the crest is about 807.2 feet above M.S.L., which makes it about 3.2 feet above the crest of the principal spillway and about 1.3 feet below the top of dam.

No low level outlet or outlet works were found for this dam. However, according to Mr. Dreyer, a 1-1/2-inch diameter pipe was provided through the embankment for use as a livestock watering system. The system was capped at the downstream end. The location of the pipe is unknown.

b. Location

Carl Dreyer Lake Dam is located in Montgomery County of the State of Missouri on an unnamed tributary of the Smith Branch of Clear Fork Creek, which flows into the Loutre River. The dam is located approximately 3 miles northwest of the town of New Florence in the northwest corner of Section 16 of Range 5 West, Township 48 North as shown on the New Florence, Missouri Quadrangle (7.5 minute series) sheet.

c. Size Classification

Carl Dreyer Lake Dam impounds less than 1,000 acre-feet but more than 50 acre-feet; which classifies it as a "small" dam. The maximum structural height is less than 40 feet and greater than 25 feet, which also leads to the classification of a "small" dam. The size classification is determined by either storage or the height, whichever gives the larger size category. Therefore, the size classification is determined to fall within the "small" category according to the "Engineer Regulation No. 1110-2-106, Appendix D" by the U.S. Department of the Army, Office of the Chief Engineer.

d. Hazard Classification

The dam has been classified as having a "high" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam or its appurtenances, excessive damage could occur to downstream property together with the possibility of the loss of life. Based upon a visual inspection of the downstream area, our findings concur with this classification. There are four dwellings and two buildings within the estimate damage zone, which extends approximately four miles downstream of the dam (see Photo 10).

e. Ownership

Carl Dreyer Lake Dam is owned privately by Dr. and Mrs. Carl J. Dreyer. The mailing address is as follows: Dr. and Mrs. Carl J. Dreyer, 45 Glen Road, Webster Groves, Missouri, 63119.

f. Purpose of Dam

The purpose of the dam is to impound water for recreational use as a private lake.

g. Design and Construction History

Carl Dreyer Lake Dam was designed by the Department of Agriculture, Soil Conservation Service, in June of 1961. The design engineer was Mr. Bernard G. Browning. Mr. Ralph Kelsick Jr. was the owner of the property when the plans for the dam were prepared, but the dam was built after Dr. Dreyer purchased the property from Mr. Ralph Kelsick Jr. According to Dr. Dreyer, the dam was constructed between January and July of 1969 by Mr. Ray Windsor of Williamsburg, Missouri.

h. Normal Operational Procedures

Normal procedure for this dam is to allow the reservoir to remain as full as possible. The water level is controlled by rainfall, runoff, evaporation, and the crest of the principal spillway.

1.3 Pertinent Data

a. Drainage Area (square miles): 0.31

b. Discharge at Damsite

Estimated experienced maximum flood (cfs):	76
Estimated ungated spillway capacity with reservoir at top of dam elevation (cfs):	173

c. Elevation (Feet above M.S.L.)

Top of dam:	808.5
Spillway crest:	
Principal Spillway	804.0 (Assumed)
Emergency Spillway	807.2
Normal Pool:	804.0
Maximum Experienced Pool:	807.7
Observed Pool:	804.0

d. Reservoir

Length of pool with water surface at top of dam elevation (feet):	1600

e. Storage (Acre-Feet)

Top of dam:	141
Spillway crest:	
Principal Spillway	78
Emergency Spillway	119
Normal Pool:	78
Maximum Experienced Pool:	127
Observed Pool:	78

f. Reservoir Surfaces (Acres)

Top of dam:	18
Spillway crest:	

Principal Spillway.	11
Emergency Spillway	15
Normal Pool:	11
Maximum Experienced Pool:.	16
Observed Pool:	15

g. Dam

Type:.	Rolled, Earthfill
Length:.	490 feet
Structural Height:	34 feet
Hydraulic Height:.	34 feet
Top width:	15 feet
Side slopes:	
Downstream.	1V to 1.75H
Upstream.	Varied from 1V to 2.5H to near vertical (Above the water surface)
Zoning:.	Homogeneous
Impervious core:	NA
Cutoff:.	A core trench with an 8-foot bottom width and side slopes of 1H to 1V (According to design drawing and Mr. Dreyer).
Grout curtain:	None
Freeboard above normal reservoir level:	4.5 feet
Volume:.	14,385 cu.yds. (According to the design drawings)

h. Diversion and Regulating Tunnel . . . . . . None

i. Spillway

Type:	
Principal Spillway	Pipe, uncontrolled
Emergency Spillway	Earthcut channel, uncontrolled
Length of crest:	
Principal Spillway	NA, 19-inch I.D. pipe

Emergency Spillway	29 feet
Crest Elevation (feet above MSL):	
Principal Spillway	804.0
Emergency Spillway	807.2

j. Regulating Outlets

Type:.	1-1/2-inch diameter livestock watering system, assumed to be abandoned. (Reportedly)
Location:.	Unknown
Length:.	Unknown
Closure:	Cap on downstream end
Maximum Capacity:.	Unknown

SECTION 2: ENGINEERING DATA

2.1 Design

Two design drawings with some construction notes on them were obtained from the Department of Agriculture, Soil Conservation Service, and are included as part of this report (see Plates 4 and 5). The drawings were prepared in June of 1961 by the Department of Agriculture, Soil Conservation Service. Flood routing calculations for the principal and emergency spillways are included as part of the drawings (see Plate 5).

Numerous discrepancies were found between our field notes and the design drawings and are mentioned below:

1. The top thickness of the dam according to the drawings, was 11 feet and field measurements show it to be 15 feet.

2. The total length of the embankment, according to the drawings, was approximately 545 feet between the right abutment and the emergency spillway and the field measured distance was 490 feet.

3. The respective distances of the two lengths of embankment also differed from that shown on the plans. The major portion, according to the drawings, was 372 feet but was field measured as 344 feet. The other portion was designed to be 173 feet but was field measured as 146 feet.

4. According to the drawings, the maximum structural height was between 27 and 24.8 feet, depending upon the anticipated settlement. Field measurements show the structural height to be 34 feet.

5. The upstream and downstream slopes according to the design drawings were 1V to 3H and 1V to 2H, respectively; our measurements show them to be 1V to 2.5H and 1V to 1.75H, respectively. However, the upstream slope was measured only above the normal water surface, which may or may not reflect the way the upstream slope was actually constructed due to the observed damage

(see Section 3.1b) to the upper portion of the slope

6. The principal spillway pipe, according to the drawings, was originally designed using a 21-inch diameter corrugated metal pipe. According to the construction notes on the drawings, the pipe was changed to a 20-inch inside diameter steel pipe. Our inspection shows that a 19-inch inside diameter welded steel pipe was used. Originally the pipe was to be bituminous coated, however, no evidence of this could be observed in the field.

7. The location of the principal spillway pipe, according to the design drawings, was 215 feet to the left of the right abutment. Field measurements show this distance as 198 feet.

8. The emergency spillway crest should be 2.2 feet above the principal spillway crest and 1.6 feet below the top of dam, if built according to the drawings; field measurements indicate that these distances are 3.2 feet and 1.3 feet, respectively. The drawings also use a 44-foot crest length for the emergency spillway, whereas a 29-foot length was measured in the field.

2.2 Construction

No data are available concerning the construction of the dam and appurtenant structures, other than the design drawings with the construction notes on them, and the information obtained from by telephone Dr. Dreyer (described below). Dr. Dreyer made available six slides that were taken during the construction of the dam. The slides are primarily general overviews of the reservoir and dam embankment and are not included in this report.

According to Dr. Dreyer, the compaction of the embankment was achieved by the activity of the earthmoving equipment across the embankment; no compaction control was employed and periodic inspections of the damsite during the construction of the dam were made by the Soil Conservation Service (No record of the visits were found). A core trench was excavated parallel to the dam axis but not into bedrock, which corresponds to what is shown on the design drawings. The trench, according to Dr. Dreyer, was excavated to an unknown depth into a suitable hard clay

(firebrick clay) foundation. The trench has a bottom width of 8 feet and side slopes of 1V to 1H, according to the design drawings.

2.3 Operation

No operational records are available for Carl Dreyer Lake Dam.

2.4 Evaluation

a. Availability

The availability of engineering data is good. The data consist of the design drawings and flood routing calculations mentioned in Section 2.1, a soil survey of Montgomery County conducted by the Soil Conservation Service, State Geological Maps, and U.S.G.S. Quadrangle Sheets.

b. Adequacy

The conclusions presented in this report are based upon field measurements, the available engineering data, past performance, and present condition of the dam. The available data and the field measurements are adequate enough to evaluate the hydraulic and hydrologic capabilities of the dam and its appurtenant structures. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity

A set of design drawings was available for review. From field measurements, the dam appears to have been basically constructed according to the available drawings; however, the drawings cannot be considered "As-built" drawings due to the discrepancies described in Section 2.1. The discrepancies between the design drawings and the field notes are considered to be minor. The only discrepancies that might have some affect on the safety of the dam and appurtenant structures would be the more steeply constructed slopes of the embankment and the smaller bottom width used in construction of the emergency spillway.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of the Carl Dreyer Lake Dam was made on June 5, 1980. The following persons were present during the inspection:

Name	Affiliation	Disciplines
Mark Haynes, P.E.	PRC Engineering Consultants, Inc.	Project Engineer, Soils and Mechanical
Jerry Kenny	PRC Engineering Consultants, Inc.	Hydraulics and Hydrology
Robert McLaughlin, P.E.	PRC Engineering Consultants, Inc.	Civil
Razi Quraishi, R.P.G.	PRC Engineering Consultants, Inc.	Geology
John Lauth, P.E.	Consoer, Townsend & Assoc., Ltd.	Civil and Structural
Bill Dreyer	Owner's Representative	

Specific observations are discussed below.

b. Dam

The overall condition of the dam appears to be fair. Some items of concern were observed and are described below.

The top of dam appears to be adequately protected against surface erosion by a well-maintained grass cover and is occasionally used as a farm access road (see Photo 2). No tire ruts or depressions, which are sometimes associated with vehicular traffic across earthen structures, were observed. No depressions or cracks indicating a settlement of the embankment were observed. No significant deviation in the vertical or horizontal alignment, other than the change in direction of the alignment was apparent. According to Mr. Dreyer, the dam has never been overtopped and no evidence indicating the contrary was observed.

The upstream slope was originally constructed with no riprap protection. According to Mr. Dreyer, riprap was placed on the upstream slope between 1970 and 1972. Evidence of the riprap was observed on the slope; however, only a small amount of riprap remained near the water surface, which did not appear to provide adequate protection against wave action. Considerable wave erosion of the slope near the normal water surface level has occurred (see Photo 4). In a few areas, the scarps due to the wave erosion extended to the top of dam, and the slope has steepened to near vertical. Undercutting of the slope was observed, which indicates future sloughing of the slope is possible. Canary reed grass was also planted near the water surface to prevent further erosion of the slope. The upper portion of the slope appeared to be adequately protected against surface erosion by an unmaintained grass cover (see Photo 1). No bulges, depressions or cracks indicating an instability of the embankment or foundation were observed on the slope.

The downstream slope was covered by a heavy growth of vegetation and small trees (see Photo 3). The vegetation hampered a comprehensive inspection of the slope. On the day of the inspection, Mr. Dreyer was in the process of removing the trees from the slope. Most of the trees measured 3 inches in diameter with one measuring 6 inches in diameter. Standing water and an area of boggy ground was observed just downstream of the toe of dam and to the left of the principal spillway outlet. The area extended approximately 100 feet to the left of the outlet. It was undetermined whether the standing water was due to seepage through the embankment or foundation or due to a recent rainstorm. No measurable flow, boils, or evidence of piping of the embankment material were observed. One small erosion gully was seen downstream of the toe on the left side of the dam. No bulges, depressions or cracks were apparent on the slope.

Both abutments slope gently upward from the top of dam. No instabilities, seepage, or erosion were observed on either abutment.

No evidence of burrowing animals was apparent on either the embankment or abutments.

c. Project Geology and Soils

(1) Project Geology

The damsite is located on an unnamed tributary of the Smith Branch of Clear Fork Creek in the Dissected Till Plains Section of the central Lowland Physiographic Province. Loess-mantled Kansas drift covers the surface of most of the Dissected Till Plains Section. This section is distinguished from the Young Drift Section to the north and from the Till Plains on the east by the stage it has reached in the post-glacial erosion cycle. Broadly generalized, this section is a nearly flat till plain submature to mature in its erosion cycle.

The topography at the damsite is flat to rolling with U-shaped valleys. Elevation of the ground surface ranges from 820 feet above M.S.L. at the damsite to 850 feet above M.S.L. nearly 0.5 miles northeast of the damsite. The reservoir slopes are in the range of 15^{o} from the horizontal at the western and northern sides, and between 8^{o} and 30^{o} from the horizontal at the northeast side of the reservoir. The area near the damsite is covered with slope wash deposits of glacial-fluvial and loess origins consisting of mottled reddish-brown to gray, silty clay.

The regional bedrock geology beneath the glacial outwash deposits in the damsite area, as shown on Geologic Map of Missouri (1979) (see Plate 6), consists of the Pennsyslvanian Marmaton-Cherokee Group rocks (cyclic deposits of shale, limestone and sandstone), Mississippian Burlington Limestone (cherty, grayish brown, sandy limestone), the Mississippian Chouteau Group, the Devonian Sulphur Springs Group (Bushberg Sandstone, Glen Park Limestone, Grassy Creek Shale), and Ordovician rocks consisting of Maquoketa Shale, Kimmswick Limestone, Cape Limestone, Joachim Dolomite, St. Peter Sandstone, and Powell Dolomite. The predominent bedrock near the damsite underlying the glacial-fluvial deposits are the Pennsylvanian cyclic deposits of shale, limestone, and sandstone of the Marmaton-Cherokee Group and Mississippian Burlington Limestone. Inlet and outlet areas of the unnamed tributary of the Smith Branch exhibit quaternary alluvium.

No faults have been identified in the vicinity of the damsite. The closest trace of a fault to the damsite is the Mineola Fault nearly 4 miles southwest of the damsite. The Mineola fault had its last movement in post-Early Ordovician time. Thus, the fault has no effect on the damsite.

Carl Dreyer Lake Dam consists of a homogenous earthfill embankment, a metallic principal spillway pipe located at the mid-section of the embankment, and an emergency spillway located near the left abutment of the embankment. Based on the data from the

available construction drawings and the visual inspection, the embankment probably rests on the glacial deposits of yellowish brown, silty clay. Available data indicates that a pre-construction exploratory boring of 5 feet was drilled along the axis of the dam near the original stream channel. This boring was terminated in clay. The emergency spillway was cut into the glacial-fluvial deposits of the left abutment.

(2) Project Soils

According to the "Soil Survey of Montgomery and Warren Counties, Missouri" published by the Soil Conservation Service in 1978, the soils in the general area of the dam belong to the Keswick-Lindley association. The soils at the damsite consist of the Keswick silt loam and clay loam, the Sharon silt loam and the Lindley loam. These soils are basically formed from glacial till and alluvium. The Keswick clay loam is generally quite susceptible to erosion. If the Keswick soil was used in the embankment, the potential of failure of the embankment would be increased due to erosion during overtopping.

Materials removed from the upstream and downstream slopes of the embankment appeared to be a light brown, silty clay with some fine to coarse sand. Based upon the Unified Soil Classification System, the soil would probably be classified as a CL. This is an impervious soil type which generally has the following characteristics: a coefficient of permeability less than 1.0 foot per year, medium shear strength, and a high resistance to piping.

d. Appurtenant Structures

(1) Principal Spillway

The principal spillway appears to be in fairly good shape, both at the inlet end and at the outlet end. However, there does not seem to be any kind of a protective coating applied to the pipe, and some resultant rust and corrosion are presently occurring (see Photos 5 and 6).

(2) Emergency Spillway

The emergency spillway approach area contains a sloughed section and resultant erosion; also, some reeds are beginning to appear in front of the inlet area (see Photo 7).

(3) Outlet Works

No low level outlets or outlet works were provided for this dam. The only operating facility at the damsite is, reportedly, a 1-1/2-inch diameter pipe used to supply water to livestock downstream. The location of the livestock watering system was unknown and the system is assumed abandoned.

e. Reservoir Area

The reservoir water surface elevation at the time of the inspection was assumed at 804 feet above M.S.L.

The surface area of the reservoir at normal water level is about 11 acres. The rim appeared to be stable with no erosional problems observed. The land around the reservoir slopes gently upward from the rim and is grass and tree covered (see Photo 9). One house, owned by Dr. Carl Dreyer, is built on the right side of the reservoir area.

f. Downstream Channel

The downstream channel is undefined and obstructed with trees and large vegetation (see Photo 8). The streambed is very narrow and shallow, and the floodplain outside of the streambed is fairly wide.

3.2 Evaluation

The visual inspection uncovered nothing of a consequential nature which would require immediate remedial action. However, the following conditions were observed which could adversely affect the dam in the near future.

1. The possible seepage, indicated by standing water and boggy ground in an area downstream of the toe and to the left of the principal spillway outlet, could affect the structural stability of the dam. It was undetermined if the condition was due to seepage or a recent rainstorm. If it was indeed due to seepage and the rate of seepage were to increase, it is possible that the seepage could transport soil particles. This could cause piping of embankment material which could lead to an eventual failure of the embankment.

2. The small trees observed on the downstream slope pose a potential danger to the safety of the dam depending upon the extent of the root system. On the day of the inspection, Mr. Dreyer was in the process of removing the trees from the slope. The roots of large trees present possible paths for piping through the embankment. The root systems can also do damage to the embankment from being uprooted by a storm.

3. The wave erosion on the upstream slope does not appear to affect the stability of the dam in its present condition. Corrective measures have been taken to control the erosion, but they appear to be ineffective. Continual erosion of the slope can only be detrimental to the stability of the dam.

4. The erosion downstream of the toe does not pose a danger to the stability of the embankment in its present condition. Nevertheless, continual erosion could endanger the stability of the dam.

5. The growth of vegetation on the embankment should be properly maintained. A tall, dense growth of vegetation on the embankment hinders a comprehensive inspection of the dam and potential problems could go undetected.

6. The rust on the principal spillway pipe does not appear severe enough to cause problems at this time.

7. The sloughed area of the emergency spillway induces a turbulent condition when excess floodwaters flow over it; this in turn could cause the situation to worsen, by exposing more of the emergency spillway inlet area to surface erosion. If the reeds in front of the emergency spillway inlet continue to grow there, an obstructed entrance could eventually be created.

8. The livestock watering system, even though it is presumed abandoned, could be a source of serious problems. A seepage path could occur along the pipe, which could cause piping of the embankment material and lead to an eventual failure of the dam.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

There are no specific procedures set forth for the operation of Carl Dreyer Lake Dam. The water level below the principal spillway crest is allowed to remain as high as possible, and is controlled by rainfall, runoff, evaporation, and unregulated spillway releases. The only operating facility at the damsite is a livestock watering system, which appears to be abandoned.

4.2 Maintenance of Dam

The dam is maintained by Dr. Carl Dreyer, the owner, and Mr. Bill Dreyer. Mr. Bill Dreyer was in the process of removing the small trees from the downstream slope on the day of the inspection. The top of dam and the emergency spillway are mowed periodically. However, the upstream and downstream slopes have received little or no maintenance and, consequently, dense vegetation and trees have grown up on the downstream slope. Riprap has been added to the upstream slope near the water's edge to prevent wave erosion. Nevertheless, the riprap is inadequate and continual erosion of the slope is evident.

4.3 Maintenance of Operating Facilities

There are no operable facilities associated with the dam, other than the assumed abandoned livestock watering system.

4.4 Description of Any Warning System in Effect

The inspection team is not aware of any existing warning system consisting of any electrical warning systems or manual notification warning plans in effect for this dam.

4.5 Evaluation

The maintenance at Carl Dreyer Lake Dam appears to be inadequate at this time, however, the dam does not appear to be neglected. The remedial measures described in Section 7 should be undertaken to improve the condition of the dam.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The watershed area of the Carl Dreyer Lake Dam upstream from the dam axis consists of approximately 200.5 acres. The watershed area is mostly crop land or wooded areas with some pasture land. Land gradients in the watershed average roughly 2 pecent. The Carl Dreyer Lake Dam is located on an unnamed tributary of the Smith Branch of Clear Fork Creek. The reservoir behind the dam is about 0.3 miles upstream from the confluence of the unnamed tributary and the Smith Branch. The watershed, at its longest arm, is approximately 0.8 miles long. A drainage map showing the watershed and the downstram hazard zone is presented as Plate 1 in Appendix B.

Evaluation of the hydraulic and hydrologic features of Carl Dreyer Lake Dam was based upon criteria set forth in the Corps of Engineers' "Engineer Regulation No. 1110-2-106" and additional guidance provided by the St. Louis District of the Corps of Engineers. The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation (PMP) using the methods outlined in the U.S. Weather Bureau Publication, Hydrometeorlogical Report No. 33. The probable maximum storm duration was set at 24 hours, and storm rainfall distribution was based upon criteria given in the Corps of Engineers' EM 1110-2-1411 (Standard Project Storm). The Soil Conservation Service (SCS) method was used for deriving the unit hydrograph, utilizing the Corps of Engineers' computer program HEC-1 (Dam Safety Version). The unit hydrograph parameters are presented in Appendix B. The SCS method also was used for determining the loss rate. The hydrologic soil group of the watershed was determined by use of published soil maps. The hydrologic soil group of the watershed and the SCS curve number are presented in Appendix

B. The curve number, unit hydrograph parameters, the PMP index rainfall and the percentages for various durations were direct input to the HEC-1 (Dam Safety Version) computer program to obtain the PMF hydrograph. The computed peak inflows of the PMF and the one-half PMF are 3,527 cfs and 1,763 cfs, respectively.

Both the PMF and the one-half PMF inflow hydrographs were routed through the reservoir by the Modified Puls Method, also utilizing the HEC-1 (Dam Safety Version) computer program. An antecedent storm of 50 percent of the PMF, preceded the PMF and an antecedent storm of 25 percent of the PMF preceded the one-half PMF, each by four days. The reservoir was assumed at the mean annual high water level at the beginning of the antecedent storm. The mean annual high water level for Carl Dreyer Lake Dam was estimated to be at the crest of the principal spillway. The antecedent storm of 50 percent of the PMF, when routed through the reservoir, will leave the reservoir at an elevation of approximately 804.45 at the end of the four-day period. Thus, the reservoir was assumed to be at the level of 804.45 at the start of the routing computation for the PMF and PMF ratio floods other than the one-half PMF. The reservoir was assumed to be at the crest of the principal spillway at the start of the routing computation for the one-half PMF. The peak outflow discharges for the PMF and the one-half PMF are 3,180 and 1,559 cfs, respectively. Both the PMF and the one-half PMF, when routed through the reservoir, resulted in overtopping of the dam.

The sizes of physical features utilized to develop the stage-outflow relation for the spillway and overtopping of the dam were taken from field notes and sketches prepared during the field inspection. The reservoir elevation-area data were obtained from the U.S.G.S. New Florence, Missouri Quadrangle topographic map (7.5 minute series). The reservoir elevation-area curve and the spillway and overtop rating curve are presented as Plates 2 and 3, respectively, in Appendix B.

From the standpoint of dam safety, the hydrologic design of a dam must aim at avoiding overtopping. Overtopping is especially dangerous for an earth dam because of its erodable characteristics. The safe hydrologic design of an embankment dam requires a spillway discharge capability combined with an embankment height that can handle a very large and exceedingly rare flood without overtopping the dam.

The Corps of Engineers designs dams to safely pass the Probable Maximum Flood that could be generated from the dam's watershed. This is the generally accepted criterion for major dams throughout the world and is the standard for dam safety where overtopping would pose any threat to human life. Accordingly, the hydrologic requirement for safety for this dam is the capability to pass the Probable Maximum Flood without overtopping the dam.

b. Experience Data

It is believed that records of reservoir stage or spillway discharge are not maintained for this site. However, according to Mr. Dreyer, the maximum observed reservoir level was approximately six inches over the crest of the emergency spillway.

c. Visual Observations

Observations made of the spillways during the visual inspection are discussed in Section 3.1d and evaluated in Section 3.2.

d. Overtopping Potential

As indicated in Section 5.1a, both the Probable Maximum Flood and the one-half Probable Maximum Flood when routed through the reservoir, resulted in overtopping of the dam. The peak outflow discharges for the PMF and the one-half PMF are 3,180 and 1,559 cfs, respectively. The maximum capacity of the spillway just before

overtopping the dam is 173 cfs. The PMF overtopped the dam by 1.41 feet and the one-half PMF overtopped the dam by 0.82 feet. The total duration of flow over the top of dam is 6.25 hours during the occurrence of the PMF and 4.17 hours during the occurrence of the one-half PMF. The spillway/reservoir system of Carl Dreyer Lake Dam is capable of accommodating a flood equal to approximately 20 percent of the PMF just before overtopping the dam. The reservoir/spillway system of Carl Dreyer Lake Dam will accommodate the one-percent chance flood (100-year flood) without overtopping the dam.

The failure of the dam could cause extensive damage to the property downstream of the dam and possible loss of life. The estimated damage zone extends approximately four miles downstream of the dam. There are four dwellings and two buildings within the damage zone.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There were no major signs of settlement or distress observed on the embankment or foundation during the visual inspection. The possible seepage observed to the left of the principal spillway outlet does not appear to affect the stability of the dam in its present condition. Nevertheless, any increase in the condition of the seepage can only be detrimental to the embankment. The erosion due to wave action on the upstream slope does not appear to be serious enough to constitute an unsafe condition, and according to Mr. Dreyer, steps have been taken to control the problem. Nevertheless, the steps taken appear to be ineffective and future sloughing is possible. The erosion downstream of the toe does not affect the stability of the dam in its present condition. There was no indication of past or present slope instability. In the absence of seepage and stability analyses, no quantitative evaluation of the structural stability can be made.

Both the principal spillway pipe and the emergency spillway channel systems appeared to be structurally stable on the day of the inspection.

b. Design and Construction Data

The design drawings and the flood routing calculations were of limited use in the assessment of the structural stability of the dam and appurtenant structures. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available. No embankment or

foundation soil parameters were available for carrying out a conventional stability analysis on the embankment. No specifications relating to the degree of embankment compaction were available for use in a stability analysis.

c. Operating Records

No operating records are available relating to the stability of the dam or its appurtenant structures. No regulated outlet works were provided for the dam, other than the assumed, abandoned livestock watering system. The water level on the day of the visual inspection was at the crest of the principal spillway. According to Mr. Dreyer, the reservoir remains close to full at all times.

d. Post Construction Changes

No post construction changes are known to exist which will affect the structural stability of the dam.

e. Seismic Stability

The dam is located in Seismic Zone 1 (see Plate 8), as defined in "Recommended Guidelines for Safety Inspection of Dams" prepared by the Corps of Engineers, and will not require a seismic stability analysis. An earthquake of the magnitude which would be expected in Seismic Zone 1 will not cause distress to a well designed and constructed earth dam. Available literature indicates that no active faults exist near the vicinity of the damsite.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation, however, the investigation is intended to identify any need for such studies.

It should be realized that the reported condition of the dam is based upon observations of field conditions at the time of inspection along with data available to the inspection team.

It is also important to realize that the condition of a dam depends upon numerous and constantly changing internal and external factors, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be assurance that an unsafe condition could be detected.

a. Safety

The spillway capacity of Carl Dreyer Lake Dam is found to be "Seriously Inadequate". The spillway/reservoir system will accommodate about 20 percent of the PMF without overtopping the dam. The safety of the embankment will be in jeopardy if the dam is overtopped. The embankment itself would be susceptible to erosion due to the high velocity of flow on its downstream slope which could lead to an eventual failure of the dam.

The dam and appurtenant structures appeared to be in fair condition. However, no quantitative evaluation of the structural safety of the embankment can be made in view of the absence of seepage and stability analyses. The present embankment and appurtenant structures, however, have performed satisfactorily since their construction without failure or evidence of instability, according to Mr. Dreyer. Mr. Dreyer also stated that, the dam has never been overtopped.

The safety of the dam can be improved if the deficiencies described in Sections 3.2 and 6.1a and below are properly corrected as described in Section 7.2b. The small trees on the downstream slope could jeopardize the safety of the dam, if continued growth is allowed.

b. Adequacy of Information

The conclusions presented in this report are based upon field measurements, limited design drawings, past performance and the present condition of the dam. The design drawings and the flood routing calculations were of limited use in the assessment of the overall safety of the dam and its appurtenant structures. Records of the operation and maintenance of the dam were not available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were also not available, which is considered a deficiency.

c. Urgency

The remedial measures recommended in Paragraph 7.2 should be accomplished within a reasonable period of time. The items recommended in paragraph 7.2a should be pursued on a high priority basis. The remedial measures should be accomplished under the guidance of a professional engineer experienced in the design and construction of earth dams.

d. Necessity for Phase II Inspection

Based upon results of the Phase I inspection, assuming the remedial measures recommended in Paragraph 7.2 are undertaken, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

a. Alternatives

There are several general options that may be considered to reduce the possibility of dam failure or to diminish the harmful aspects of such a failure. Some of these options are:

1. Increase the spillway capacity to pass the PMF without overtopping the dam.

2. Increase the height of the dam enough to pass the PMF without overtopping the dam; an investigation should be done which also includes studying the effects on the structural stability of the existing embankment. The overtopping depth during the occurrence of the PMF, stated in Section 5.1d, is not the required or recommended increase in the height of the dam.

3. A combination of 1 and 2 above.

b. O & M Procedures

1. The area of standing water and boggy ground to the left of the principal spillway outlet should be further investigated to determine if the condition is due to seepage or a recent rainstorm. If the condition is indeed due to seepage, the area should be monitored to detect any changes in location, turbidity, and quantity of water. Any changes should be investigated further and repairs made as necessary.

2. All of the small trees on the downstream slope should be removed from the slope and prevented from regrowing.

3. The erosion due to wave action on the upstream slope should be properly repaired and adequately protected from further damage.

4. The erosion downstream of the toe should be monitored and properly repaired when deemed necessary.

5. The vegetation on the embankment, especially the vegetation on the downstream slope, should be properly maintained and an adequate vegetative cover retained on the embankment to protect it from surface erosion and to prevent excessive erosion in the event the dam is overtopped. Large vegetation, such as bushes and trees, should be prevented from growing on the embankment.

6. The sloughed area in the emergency spillway approachway should be repaired to the extent that a smooth transition of flow would exist during use by excess reservoir overflows. Also, the growth of the reeds near the entrance of the emergency spillway should be maintained in such a

manner as to prevent any possible obstruction effect from occurring. The emergency spillway channel should be adequately protected to avoid excessive erosion in the channel during flows through the spillway.

7. The rusting of the principal spillway pipe should be monitored and repairs made when deemed necessary.

8. The location of the livestock watering system should be determined and the area around the pipe monitored to detect potential problems. Any associated problems with the pipe should be properly repaired.

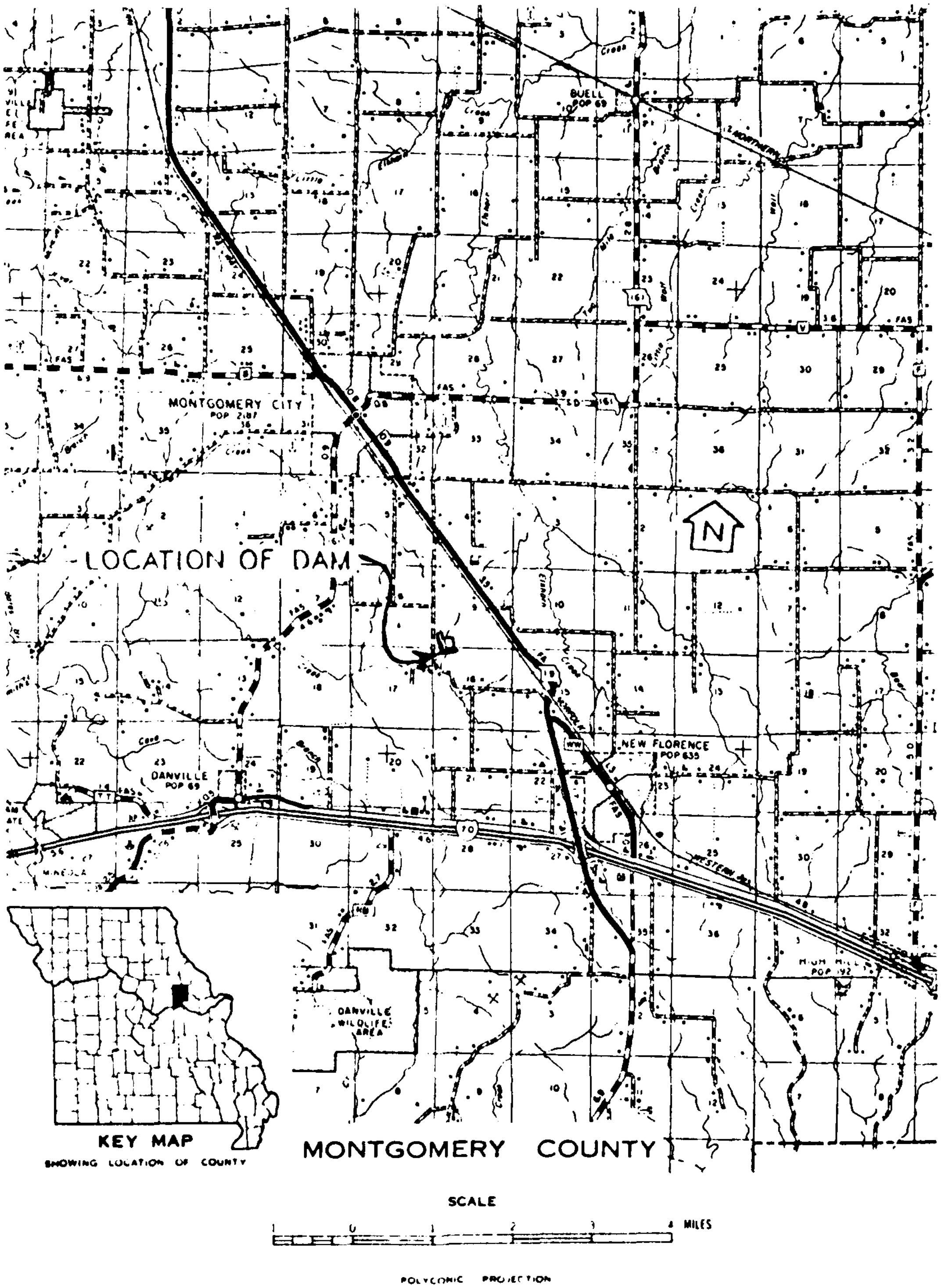
9. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of earth dams.

10. The owner should initiate the following programs:

    (a) Periodic inspection of the dam by a professional engineer experienced in the design and construction of earth dams.

    (b) Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

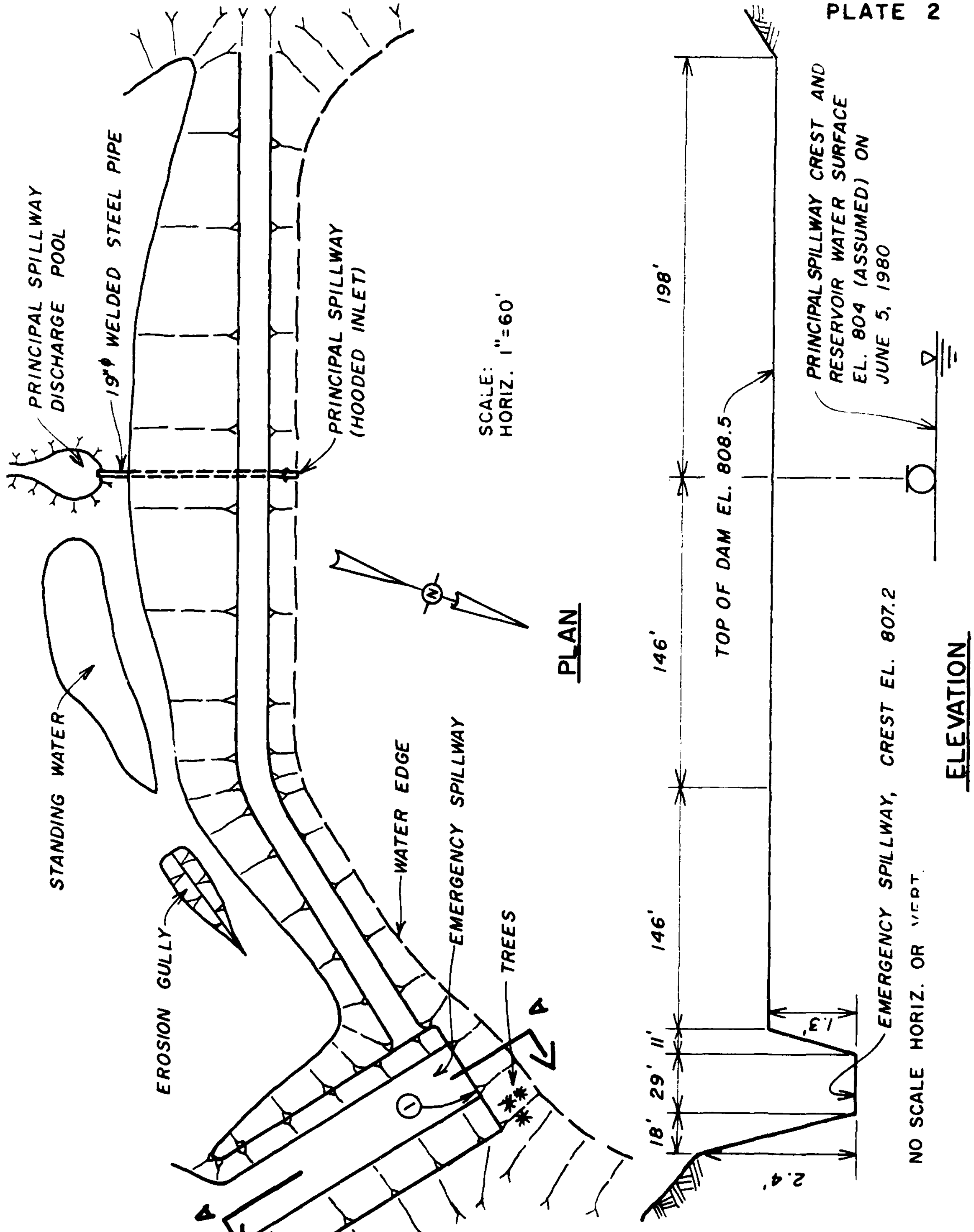
PLATES



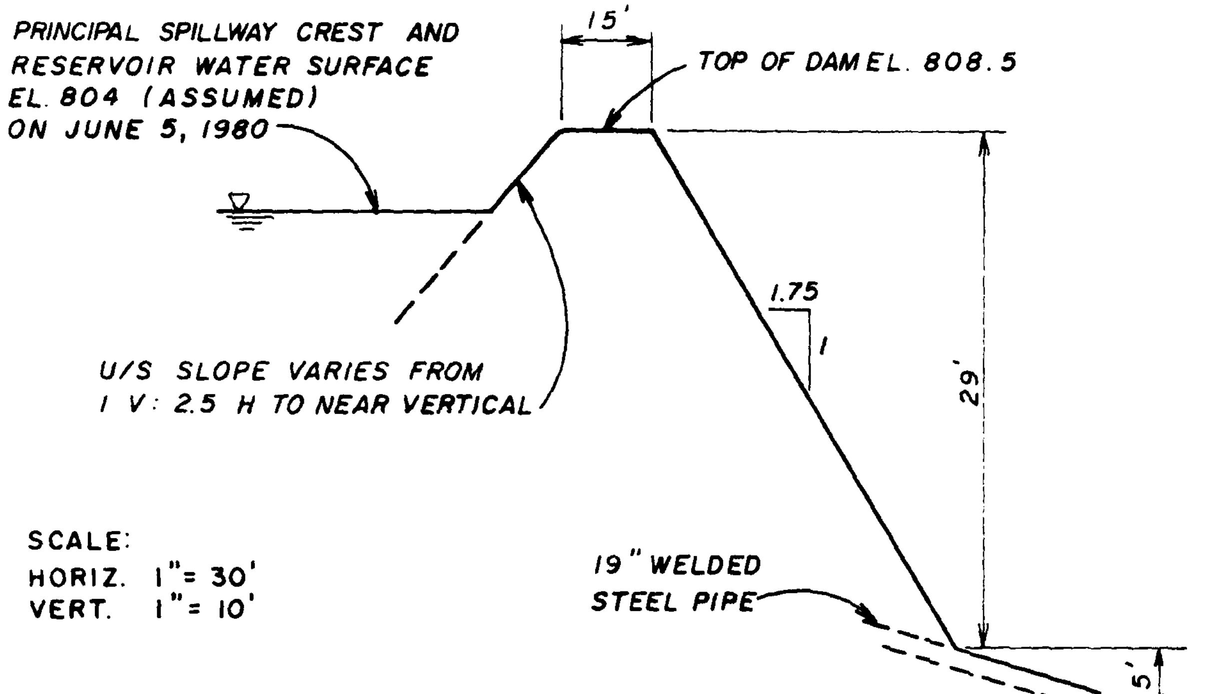
LOCATION MAP – CARL DREYER LAKE DAM

MO. 10158

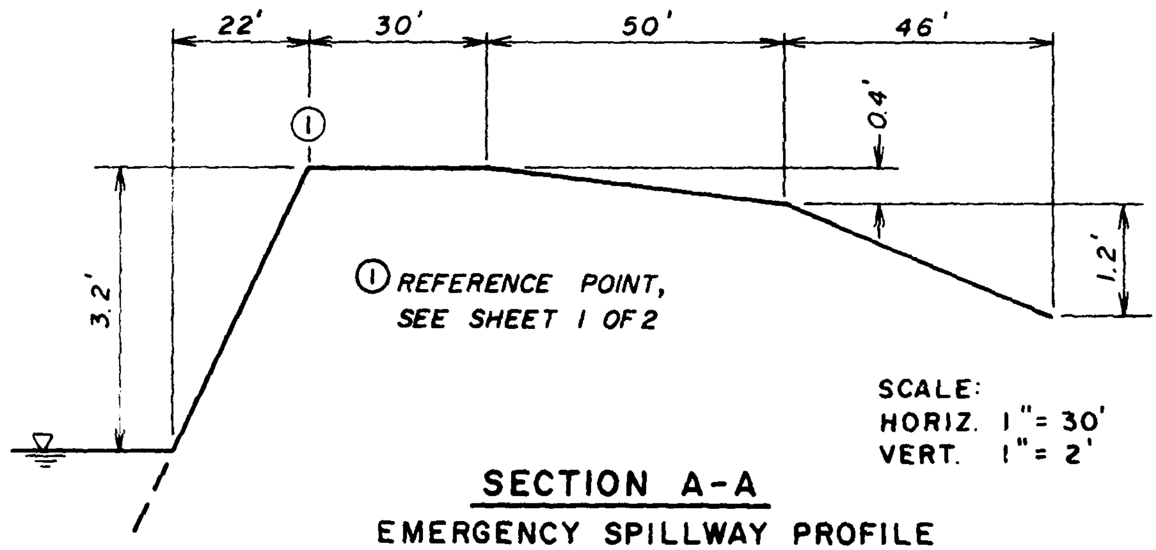
PLATE 2



CARL DREYER LAKE DAM (MO. 10158)
PLAN AND ELEVATION



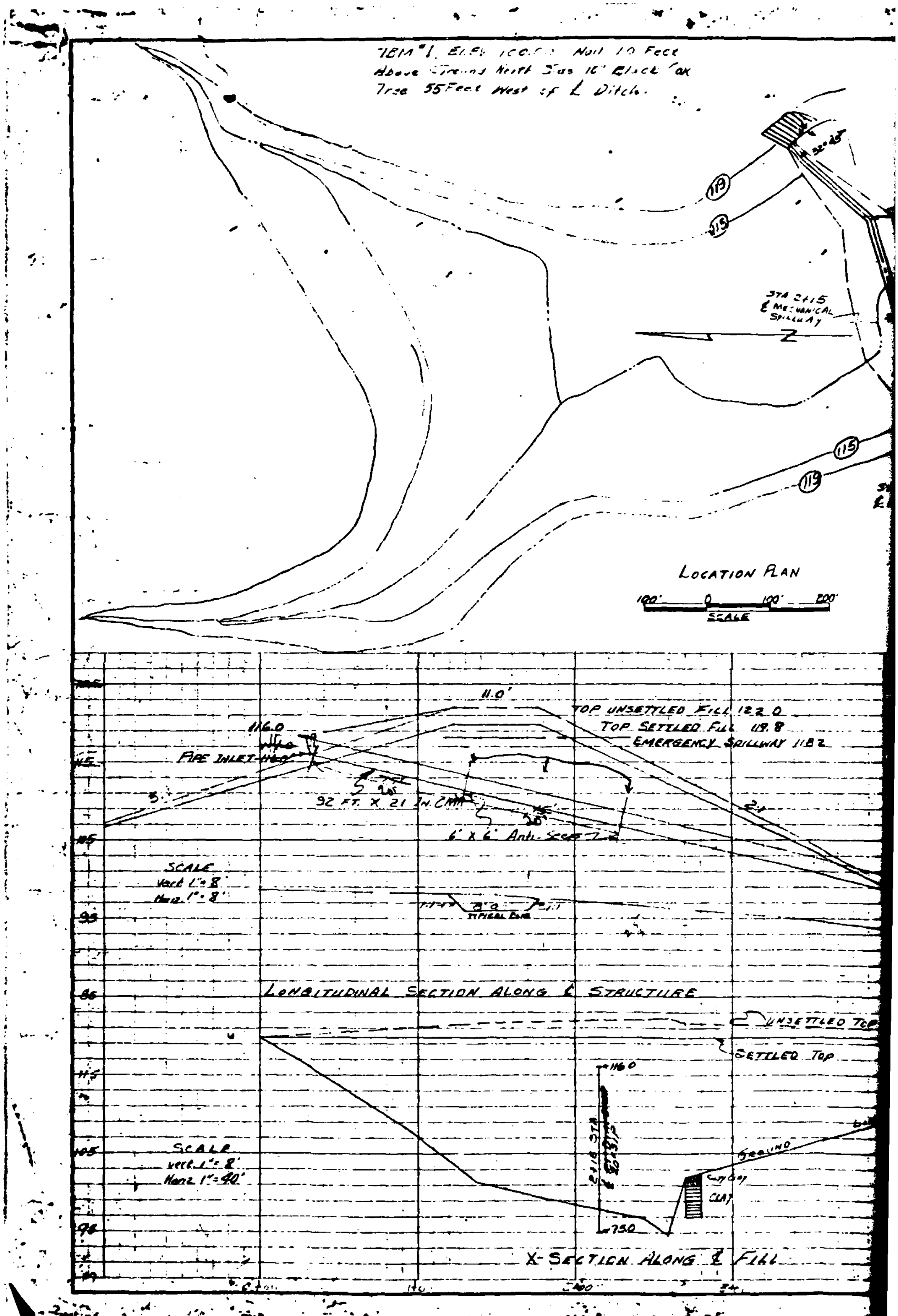
MAXIMUM SECTION



SECTION A-A

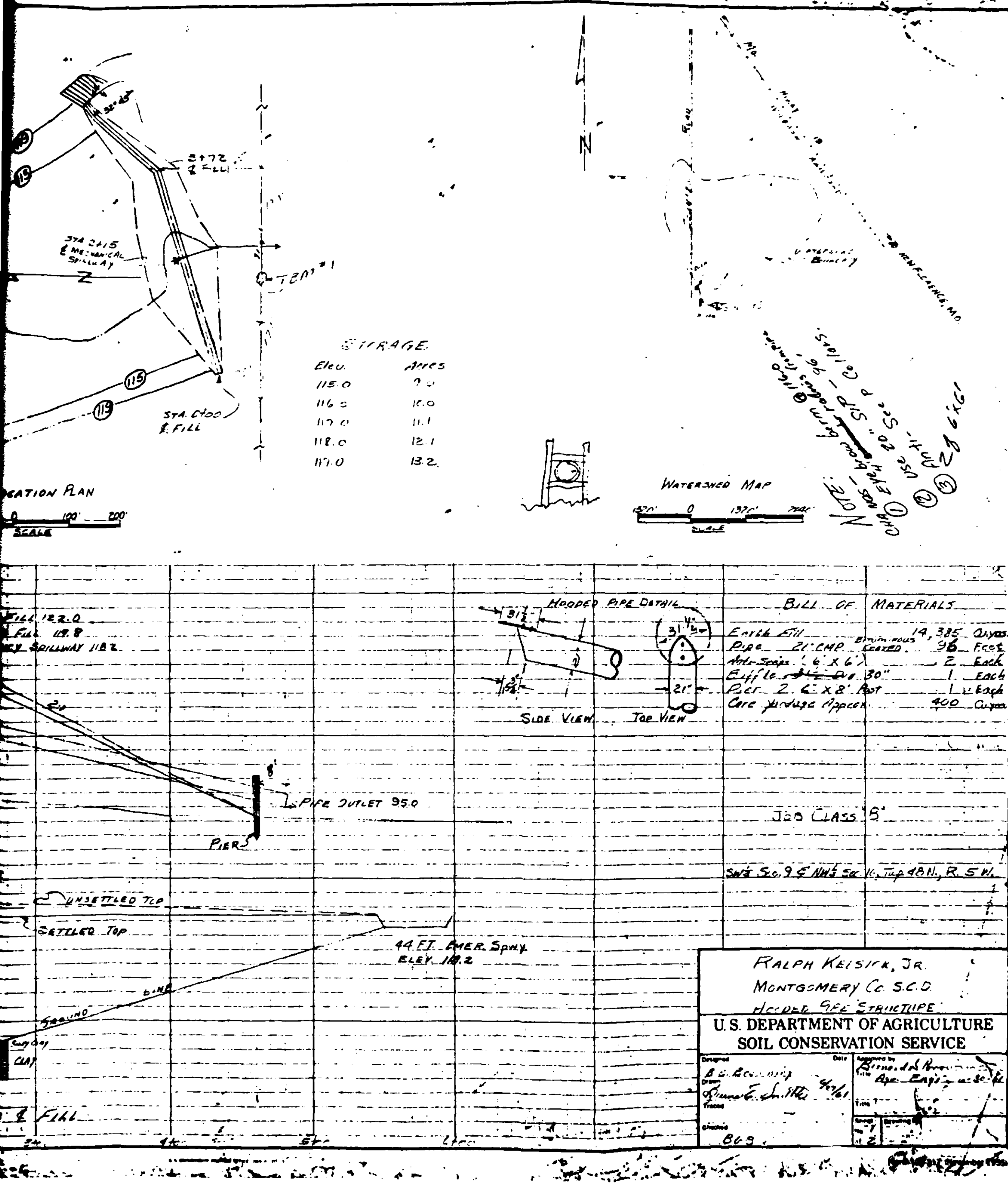
EMERGENCY SPILLWAY PROFILE

CARL DREYER LAKE DAM (MO. 10158)
MAXIMUM SECTION OF EMBANKMENT AND
EMERGENCY SPILLWAY PROFILE
(SHEET 2 TO 2)



Tree 55 Feet West of ℄ Ditch.
STA 2+15
℄ MECHANICAL SPILLWAY
LOCATION PLAN
100' 0 100' 200'
SCALE
11.0'
TOP UNSETTLED FILL 122.0
TOP SETTLED FILL 119.8
EMERGENCY SPILLWAY 118.2
116.0
PIPE INLET
92 FT. X 21 IN. CMP
6' x 6' Anti-Seep
SCALE
Vert 1" = 8'
Horiz 1" = 8'
LONGITUDINAL SECTION ALONG ℄ STRUCTURE
UNSETTLED TOP
SETTLED TOP
116.0
GROUND
CLAY
SCALE
Vert 1" = 8'
Horiz 1" = 40'
X-SECTION ALONG ℄ FILL

PLATE 4



STA 2+15
℄ MECHANICAL SPILLWAY
STA 3+72
℄ FILL
STA 0+00
℄ FILL
TBM #1
LOCATION PLAN
0 100' 200'
SCALE
STORAGE
Elev. Acres
115.0 9.0
116.0 10.0
117.0 11.1
118.0 12.1
119.0 13.2
WATERSHED MAP
1320' 0 1320' 2640'
SCALE
TO NEW FLORENCE, MO
NOTE: CHANGES
① Extend berm 96 feet
② Use 20 sec. S.P. Collars
③ Zg 6x6'
FILL 122.0
FILL 119.8
EMERGENCY SPILLWAY 118.2
HOODED PIPE DETAIL
SIDE VIEW
TOP VIEW
BILL OF MATERIALS
Earth Fill 14,385 Cu.yds.
Pipe 21" CMP Bituminous Coated 96 Feet
Anti-Seeps (6' x 6') 2 Each
Baffle 30" 1 Each
Pier 2 6" x 8' Post 1 Each
Core Trench 400 Cu.yds.
PIPE OUTLET 95.0
PIER
JOB CLASS "B"
SW¼ Sec. 9 & NW¼ Sec. 16, Twp 48N., R. 5 W.
UNSETTLED TOP
SETTLED TOP
44 FT. EMER. SPWY.
ELEV. 118.2
GROUND LINE
CLAY
℄ FILL
RALPH KEISICK, JR.
MONTGOMERY Co. S.C.D.
HOODED PIPE STRUCTURE
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

WATERSHED DATA

Drainage Area = A
Uncontrolled = 170 Acres = .266 Sq Mi
Controlled = ______ Acres = ______ Sq Mi
Total A = 170 Acres = .266 Sq Mi
Degree of Hazard ______
Hydrologic Soil Group ______
Weighted Design Runoff Curve 75 for Moist Cond II
Design Runoff Curve ______ for Moist Cond III

Time of Concentration
Length of Watershed = 3700 Feet
Difference in Elevation = ______ Feet
T_c (from Nomograph 3-L-45007) = 0.33 Hours
Average Velocity = ______ ft per sec
Incremental Subhydrograph Dimensions
ΔD = ______ Hours
$T_p = \frac{\Delta D}{2} + 0.6\,T_c$ = ______ + 0.6 T_c = ______ Hours
$T_b = 2.67\,T_p$ = ______ Hours
Peak Rate of runoff for Subhydrographs = q_x
$q_x = \frac{484A\,(\text{sq mi}) \cdot \Delta Q}{T_p}$ = ______ ΔQ cfs

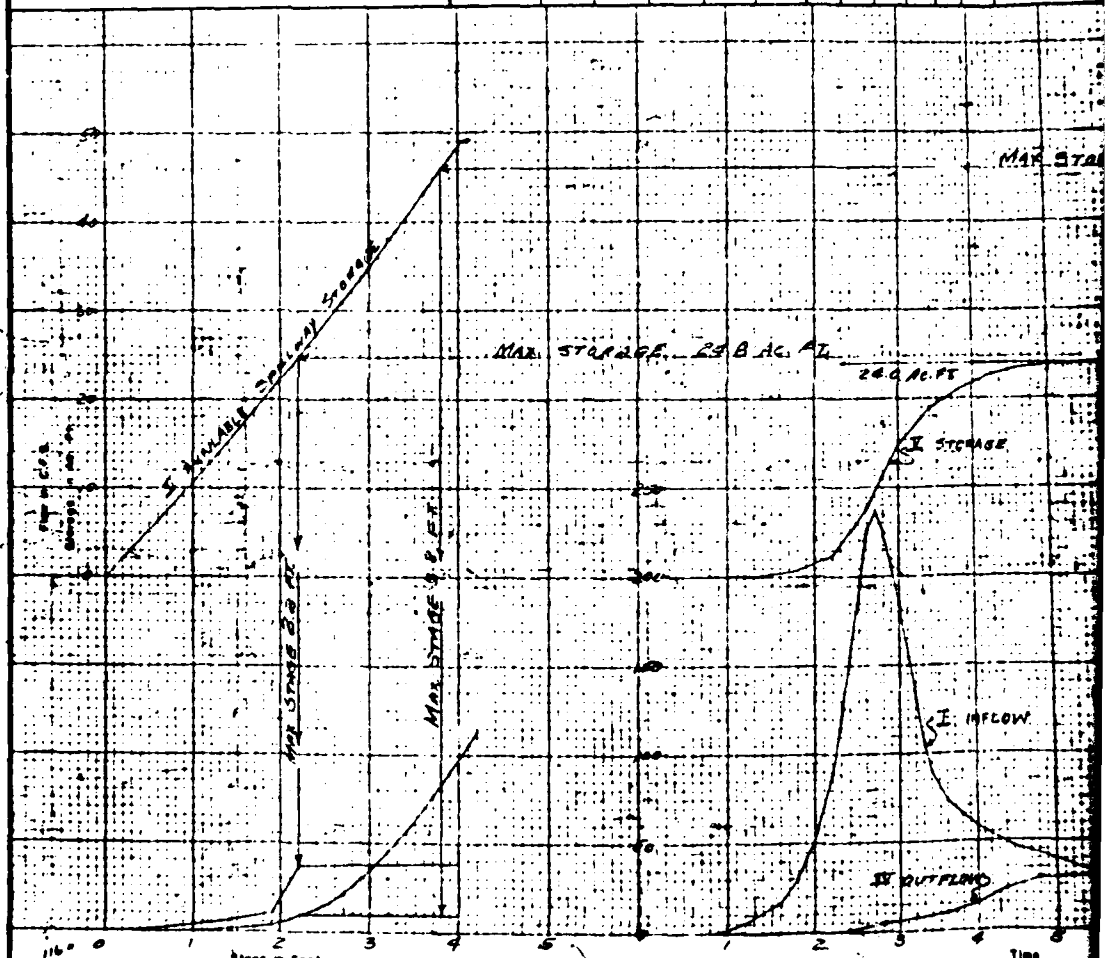
Estimated SEDIMENT STORAGE Required Ac Ft ______

AVAILABLE SEDIMENT & SPILLWAY STORAGE

ELEV.	Stage in Feet	Area Flooded Acres	Interval Storage Acre Feet	Cumulative Storage Sediment Ac Ft	Cumulative Storage Water Ac Ft
116.0		10.0			0
			10.55		
117.0		11.1			10.55
			11.60		
118.0		12.1			22.15
			12.65		
119.0		13.2			34.80
			13.75		
120.0		14.3			48.55

WEIR — Low Stage — of Elev ______ Size ______ $Q = CLh^{3/2}$ C = ______ L = ______ ft Q = ______ cfs | h Feet | cfs | Q cfs

ORIFICE — Low Stage — Elev ______ Size ______ $Q = Ca(2gh)^{1/2}$ C = ______ a = ______ sq ft Q = ______ cfs | h Feet | cfs | Q cfs



HYDROGRAPH DATA

	PRINCIPAL SPILLWAY	EMERGENCY SPILLWAY	CHECK
Precipitation Frequency	25 yrs		
6 Hr Rainfall (3-L-3441, sheet 9) P =	4.5 in	75% 12.5 in Point Rainfall = 9.37	
6 Hr Point Rainfall (ES-1002) P =		7.37 in	in
Ratio of Area to Point Rainfall (ES-1003) =	98 %	98 %	%
6 Hr Area Rainfall (Modified P) =	4.41 in	7.18 in	in
For High Hazard (1.5 × Modified P) =		in	
For High Hazard (2.5 × Modified P) =			in

HYDROGRAPH DEVELOPMENT FOR PRINCIPAL SPILLWAY DESIGN

Time Hours	Accum Precip Percent	Controlled Inflow cfs	Accum Precip P - in	Accum Runoff Q - in	ΔQ in	q_x cfs
0.0	0.0					
0.5	3.5					
1.0	8.0					
1.5	13.5					
2.0	23.0					
2.5	60.0					
3.0	70.5					
3.5	78.0					
4.0	83.5					
4.5	88.0					
5.0	92.5					
5.5	96.5					
6.0	100.0					
6.5						
7.0						
7.5						
8.0						

Total ______ in

Total Vol Runoff = R = $\frac{2.23}{12}$ × A (ac) 170 = 31.6 Ac Ft

306

PLATE

PRINCIPAL SPILLWAY DISCHARGE

WEIR

ORIFICE

CONDUIT

WEIR

CONDUIT

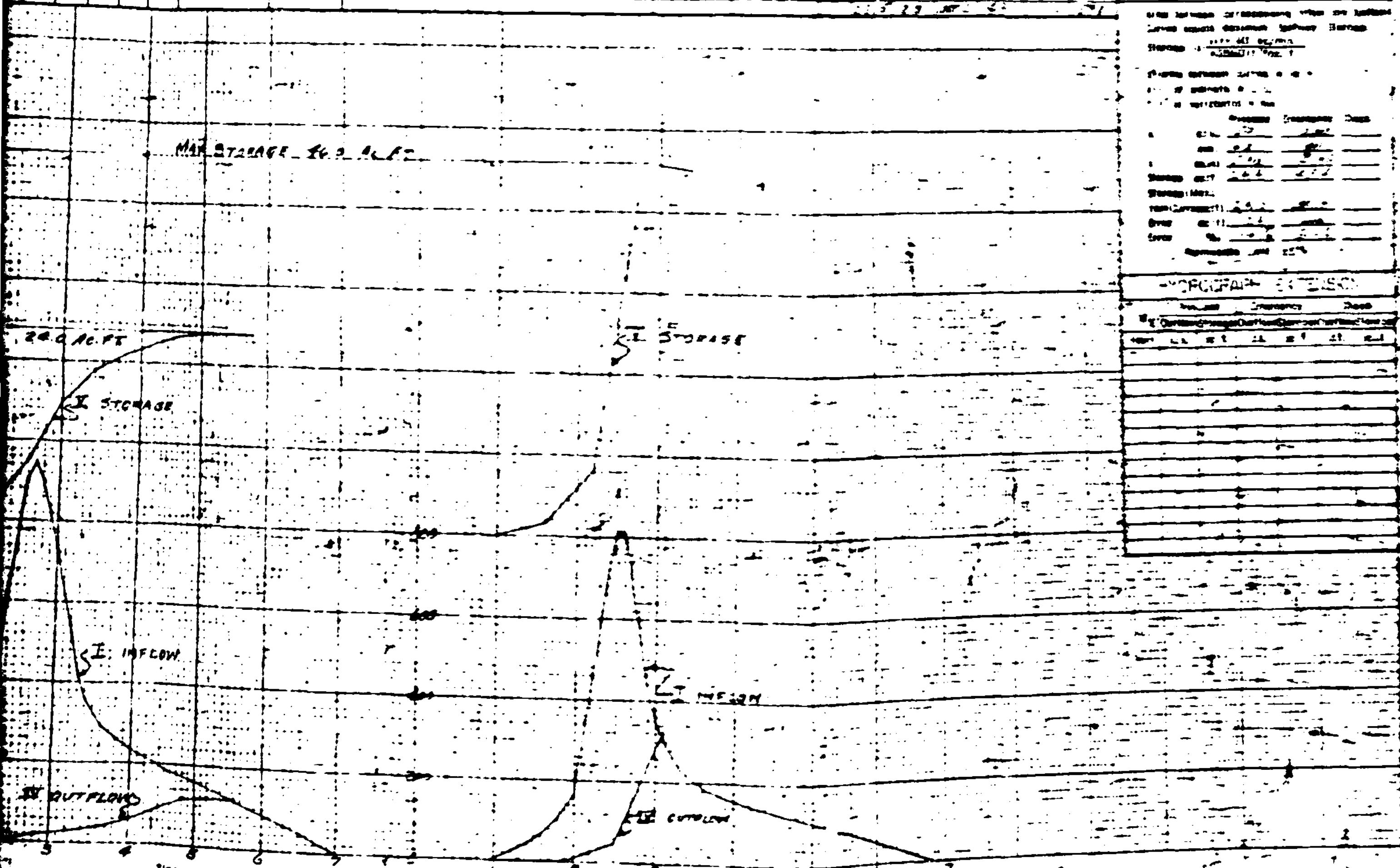
EMERGENCY

TIME CONVERSION FACTOR

CHECK INFLOW HYDROGRAPH

CHECK OF FLOOD ROUTING

HYDROGRAPH EXTENSION



HYDROGRAPH DEVELOPMENT FOR PRINCIPAL SPILLWAY DESIGN

HYDROGRAPH DEVELOPMENT FOR EMERGENCY SPILLWAY DESIGN

HYDROGRAPH DEVELOPMENT FOR ... HAZARD DESIGN

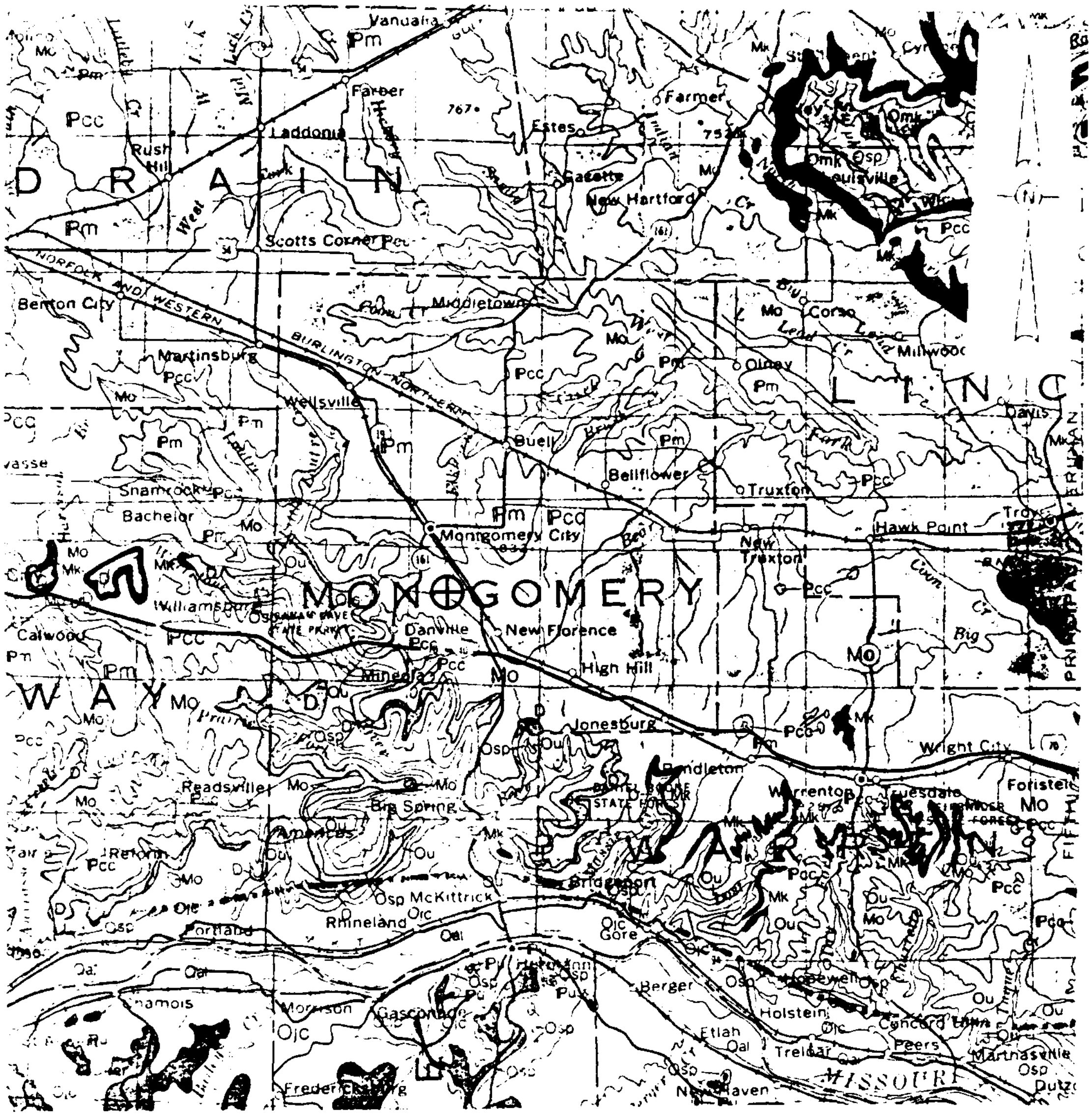
SUMMARY DATA

FLOOD ROUTING ... EMERGENCY SPILLWAY

U. S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

PLATE 6



SCALE

0 10 20 30 40 Miles

⊕ LOCATION OF DAM

NOTE: LEGEND OF THIS DAM IS ON PLATE 7

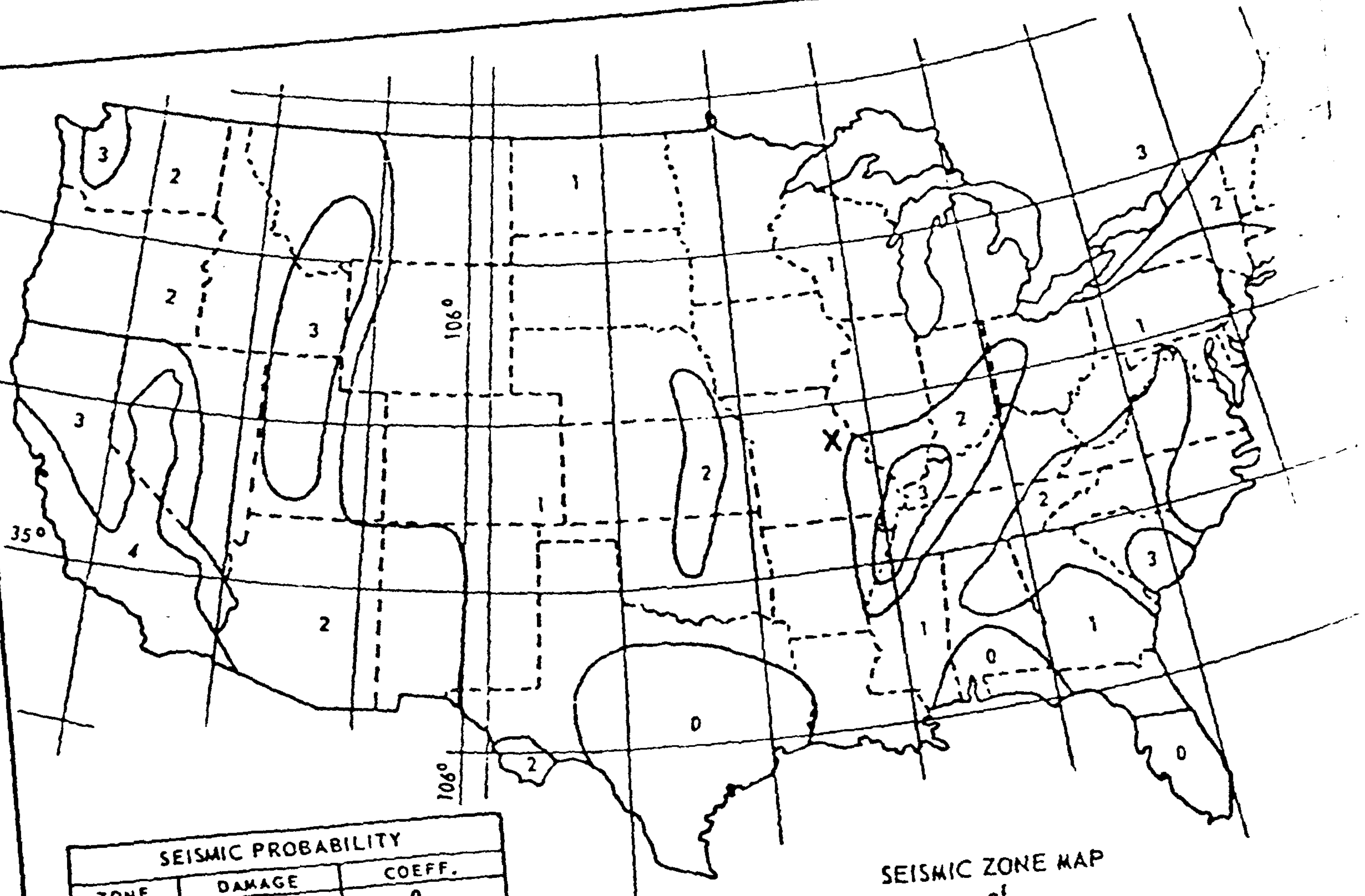
REFERENCE:

GEOLOGIC MAP OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
MISSOURI GEOLOGICAL SURVEY
KENNETH H. ANDERSON, 1979

REGIONAL GEOLOGICAL MAP
OF
CARL DREYER LAKE DAM

LEGEND

PERIOD	SYMBOL	DESCRIPTION
QUATERNARY	Qal	ALLUVIUM: SAND, SILT, GRAVEL
PENNSYLVANIAN	Pm	MARMATON GROUP: CYCLIC DEPOSITS OF SHALE, LIMESTONE AND SANDSTONE
	Pcc	CHEROKEE GROUP: CYCLIC DEPOSITS OF SHALE, LIMESTONE AND SANDSTONE
MISSISSIPPIAN	Mo	KEOKUK-BURLINGTON FORMATION: CHERTY GRAYISH BROWN SANDY LIMESTONE
	Mk	CHOUTEAU GROUP: BACHELOR, AND HANNIBAL FORMATION (LIMESTONE AND SHALE)
DEVONIAN	D	SULPHUR SPRING GROUP: BUSHBERG SANDSTONE, GLEN PARK LIMESTONE, GRASSY CREEK SHALE
ORDOVICIAN	Ou	MAQUOKETA SHALE, KIMMSWICK LIMESTONE
	Omk	CAPE LIMESTONE
	Ojd	JOACHIM DOLOMITE
	Osp	ST PETER SANDSTONE
	Ojc	SMITHVILLE FORMATION, POWELL DOLOMITE



SEISMIC ZONE MAP
of
CONTIGUOUS STATES

SEISMIC PROBABILITY		
ZONE	DAMAGE	COEFF.
0	NONE	0
1	MINOR	0.025
2	MODERATE	0.05
3	MAJOR	0.10
4	GREAT	0.15

X APPROXIMATE LOCATION OF CARL DREYER LAKE DAM

APPENDIX A

PHOTOGRAPHS TAKEN DURING INSPECTION

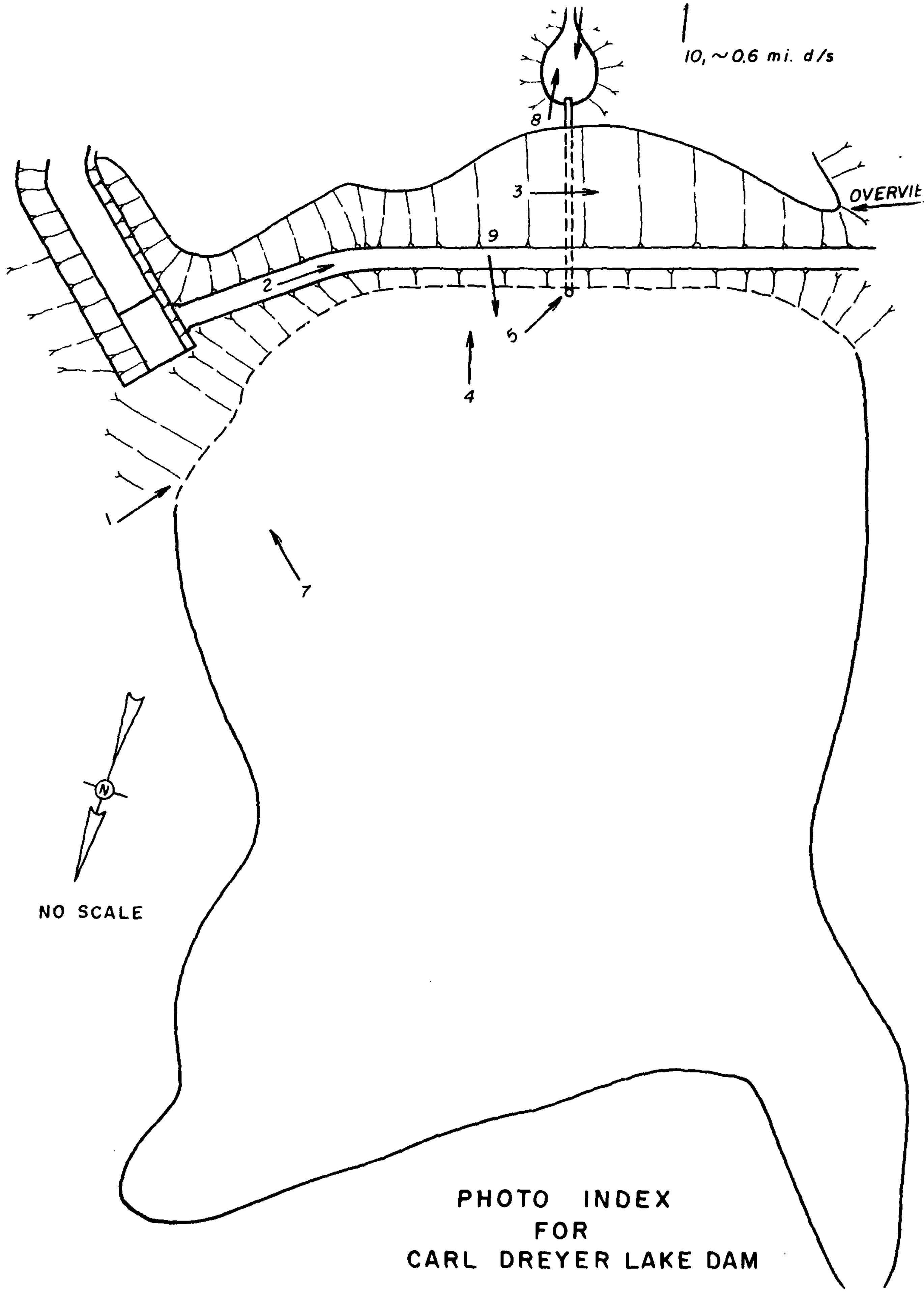


PHOTO INDEX
FOR
CARL DREYER LAKE DAM

Carl Dreyer Lake Dam

Photographs

Photo 1 - View of the upstream slope showing the location and type of the principal spillway.

Photo 2 - View of the top of dam showing the maintained vegetative cover and the curvature at the intersection of the two straight lengths of the embankment.

Photo 3 - View of the downstream slope showing the dense vegetative growth of grass, bushes, and trees.

Photo 4 - View of the upstream slope showing the scarps caused by the wave erosion of the slope, some undercutting, and the scarcity of riprap.

Photo 5 - View of the principal spillway pipe inlet showing the steel hood provided as an anti-vortex device, and the lack of any protection coating.

Photo 6 - View of the principal spillway outlet and the discharge pool. Note dense vegetation on downstream slope.

Photo 7 - View of the emergency spillway control section showing trees, and dense vegetation, and partial encroachment by reeds which obstructs the inlet and discharge channel of the spillway.

Photo 8 - View of obstructed downstream channel just downstream of the principal spillway outlet.

Photo 9 - View of the reservoir and rim.

Photo 10 - View of a dwelling approximately 0.6 miles downstream of the dam showing the downstream channel (Smith Branch of Clear Fork Creek) on the right side of the Photo.

Photo 1

Photo 2

Photo 3

Photo 4

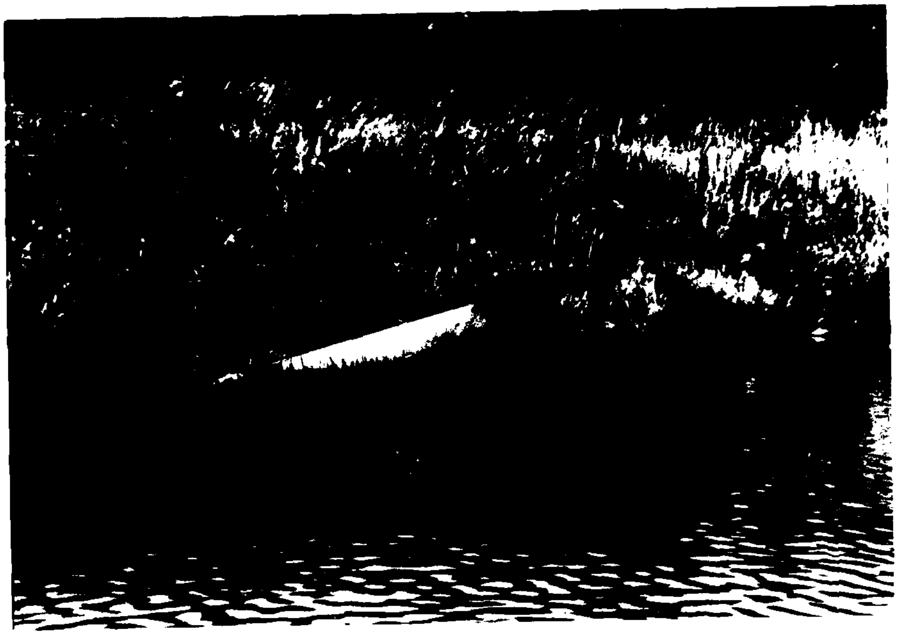


Photo 5

Photo 6

Photo 7

Photo 8

Photo 9

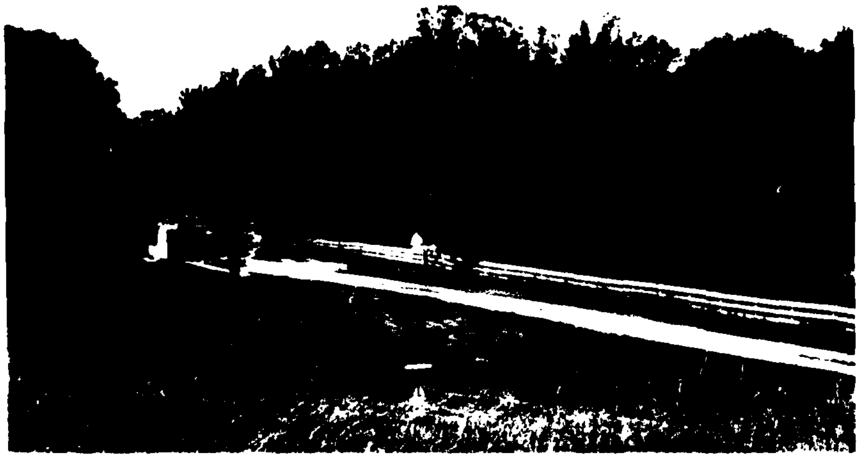
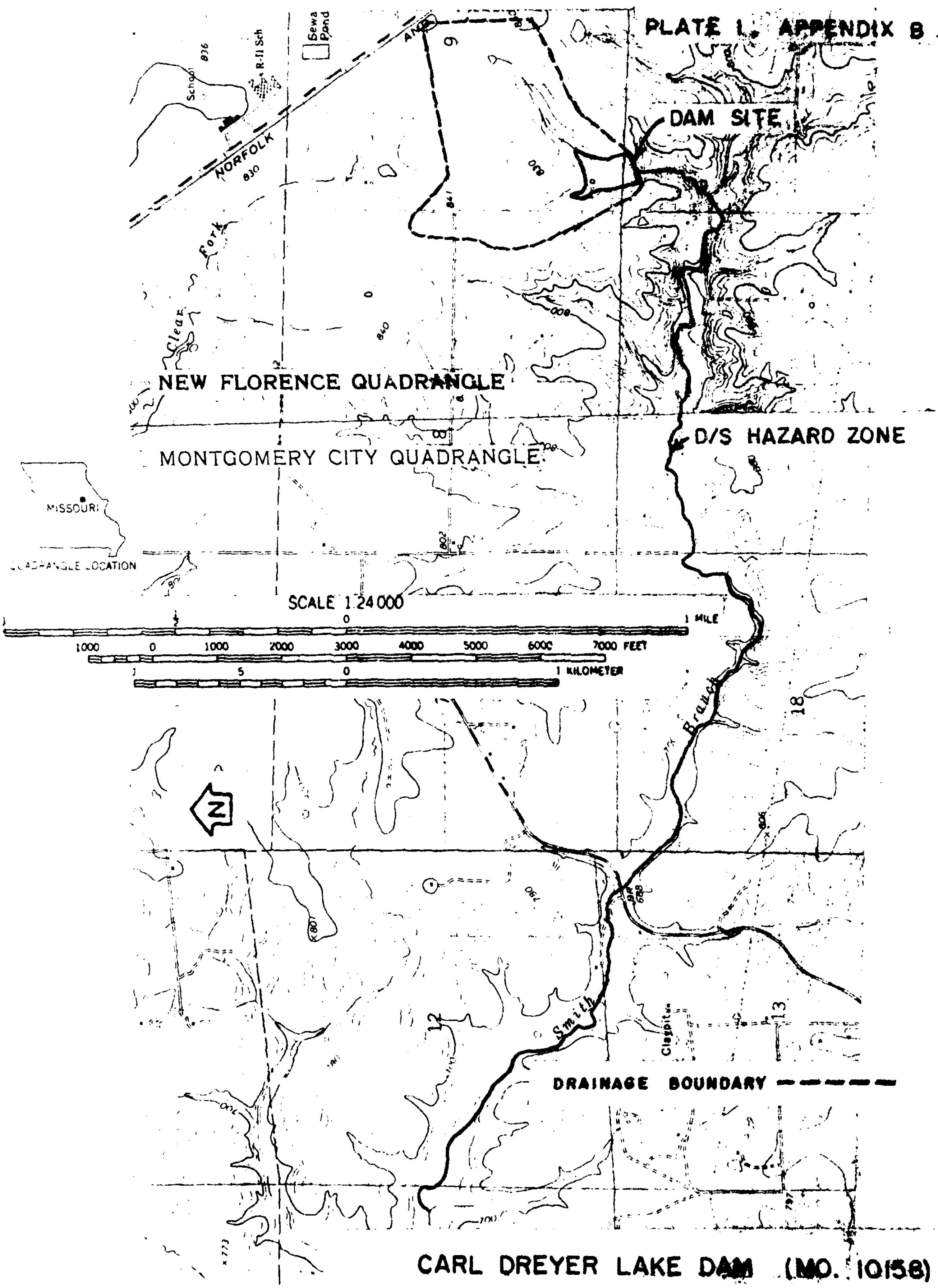


Photo 10

APPENDIX B

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



CARL DREYER LAKE DAM (MO. 10158)
DRAINAGE BASIN AND
DOWNSTREAM HAZARD ZONE

ECI-4 **PRC ENGINEERING CONSULTANTS, INC.**

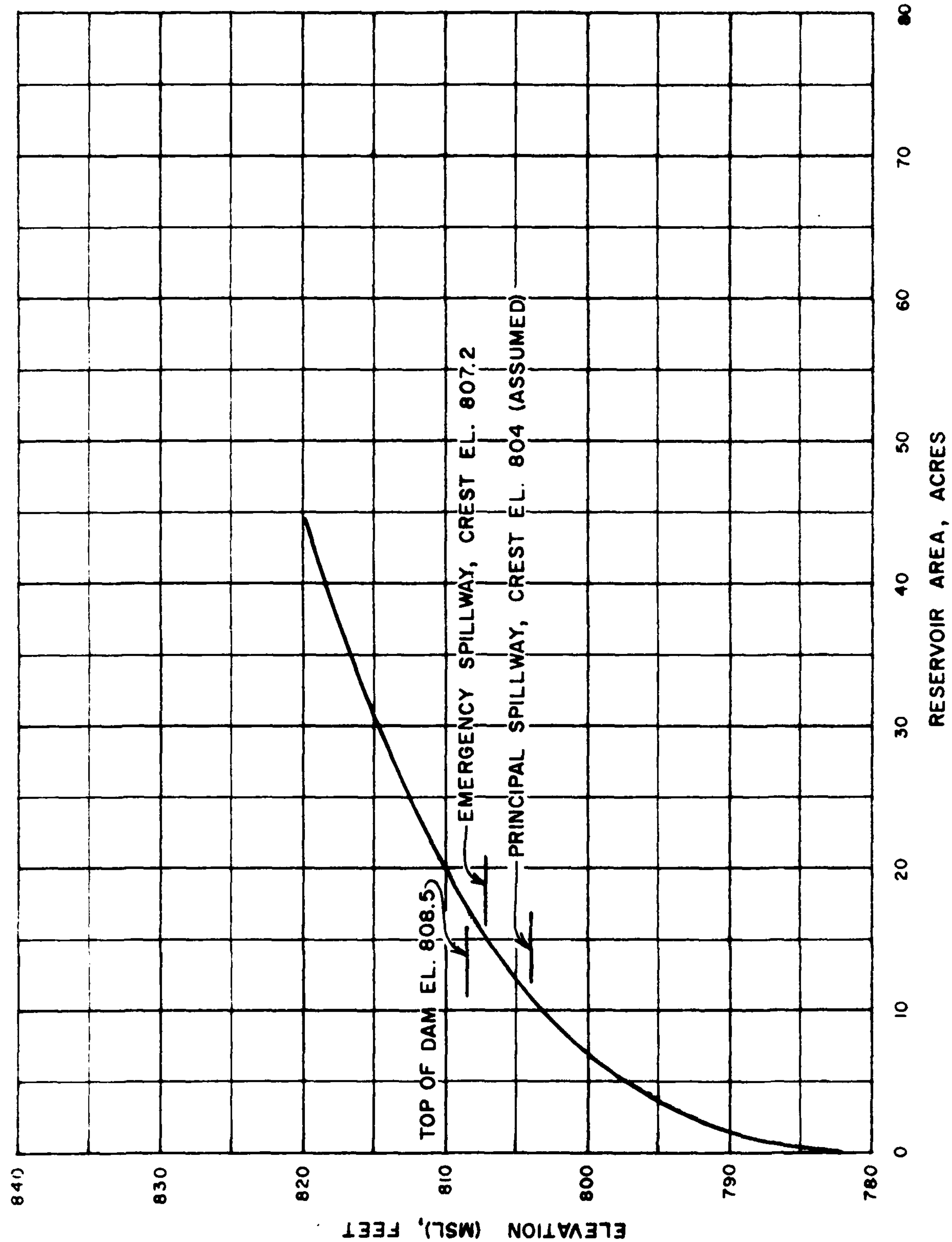
Dam Safety Inspection - Missouri — SHEET NO. ______ OF ______

Dam Name: Carl Dreyer Dam / ID No.: 10158 — JOB NO. 1263

Reservoir Elevation - Area Data — BY BD — DATE 7/8/80

1 planimetered unit = 0.9[illegible] acres

ELEV. (M.S.L.) (Ft.)	RESERVOIR SURFACE AREA (Acres)	REMARKS
792	0	Estimated Reservoir Streambed
800	7	Planimetered - USGS "New Florence, Mo." 7½ min. quad.
804	11	Spillway Crest - (assumed elev.) Planimetered
[illegible]	15	Emergency Spillway (interpolated from curve)
808.5	18	Top of Dam (interpolated from curve)
810	20	Planimetered - USGS "New Florence, Mo." 7½ min.
820	45	" "



CARL DREYER LAKE DAM (MO. 10158)
RESERVOIR ELEVATION - AREA CURVE

PRC ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI — SHEET NO. ___ OF ___

DAM NAME: [illegible] (10158) — JOB NO. 1263

UNIT HYDROGRAPH PARAMETERS — BY [illegible] DATE 6/30

1) DRAINAGE AREA, $A = 0.313$ sq. mi = (200.5 acres)

2) LENGTH OF STREAM, $L = (1.3'' \times 2000' = 2600') = 0.49$ mi.

3) ELEVATION AT DRAINAGE DIVIDE ALONG THE LONGEST STREAM,

$$H_1 = 843$$

4) ELEVATION OF RESERVOIR AT SPILLWAY CREST, $H_2 = 804$

5) ELEVATION OF CHANNEL BED AT 0.85L, $E_{85} = 841$

6) ELEVATION OF CHANNEL BED AT 0.10L, $E_{10} = 807$

7) AVERAGE SLOPE OF THE CHANNEL, $S_{AVG} = (E_{85} - E_{10}) / 0.75L = (841 - 807)/1950 = 0.017$

8) TIME OF CONCENTRATION:

A) BY KIRPICH'S EQUATION,

$$t_c = [(11.9 \times L^3)/(H_1 - H_2)]^{0.385} = [(11.9 \times 0.49^3)/(843-804)]^{0.385} = 0.29 hr.$$

B) BY VELOCITY ESTIMATE,

SLOPE = 0.017 ⟹ AVG. VELOCITY = 2.0 fps

$$t_c = L/V = 2600 ft/(2 fps \times 3600 s/hr) = 0.36 hr.$$

USE $t_c = 0.29$ hr.

9) LAG TIME, $t_\ell = 0.6\, t_c = 0.6(0.29) = 0.17$ hr.

10) UNIT DURATION, $D \leq t_\ell / 3 = 0.17 hr/3 = 0.057$ < 0.083 hr.

USE D = .083 hr. = 5 min

11) TIME TO PEAK, $T_p = D/2 + t_\ell = 0.083/2 + 0.17 = 0.21$ hr.

12) PEAK DISCHARGE,

$$q_p = (484 \times A)/T_p = (484 \times 0.313 sq.mi.)/0.21 hr. = 721 cfs$$

ECI-4 **PRC ENGINEERING CONSULTANTS, INC.**

DAM SAFETY INSPECTION / MISSOURI - 1980 SHEET NO. ______ OF ______

DAM NAME: CARL DREYER DAM (10158) JOB NO. 1263

CURVE NUMBER DETERMINATION BY BY DATE 6/30

I) SOIL GROUP

WATERSHED SOILS IN THE BASIN CONSIST OF:

PUTNAM (GR. D), MEXICO (GR. D)

GROUP D SOILS SEEM TO PREDOMINATE THE BASIN. THEREFORE, ASSUME GROUP D SOILS FOR THE ENTIRE WATERSHED FOR HYDROLOGIC PURPOSES.

II) COVER COMPLEX

ASSUMED LAND USE	ASSUMED HYDROLOGIC CONDITION	PER CENT AREA	CN (AMC II)
CROPS (contoured)	GOOD	50%	86
WOODS	FAIR	40%	79
PASTURE	FAIR	10%	84

III) CURVE NUMBER

WEIGHTED AVERAGE CN = 83 FOR AMC II

CURVE NUMBER = 93 FOR AMC III

ECI-4 **PRC ENGINEERING CONSULTANTS, INC.**

DAM SAFETY INSPECTION / MISSOURI — SHEET NO. ____ OF ____
DAM NAME: CARL DREYER DAM (10158) — JOB NO. 1263
PROBABLE MAXIMUM PRECIPITATION — BY BJ — DATE 6/30

DETERMINATION OF PMP

1) Determine drainage area of the basin

D.A. = 0.313 sq. mi. (200.5 acres)

2) Determine PMP Index Rainfall (for D.A. = 200 sq. mi. & 24 hr. duration)

Location of centroid of basin,

Long. = 91° 28′ 35″ W   Lat. = 38° 56′ 26″ N

PMP = 24.8 (from Fig. 1, HMR 33)

Zone = 7

3) Determine basin rainfall in terms of percentage of PMP Index Rainfall for various durations.
(from Fig. 2, HMR 33)

Duration (Hrs.)	Percent of Index Rainfall (%)	Total Rainfall (Inches)	Rainfall Increments (Inches)	Duration of Increment (Hrs.)
6	100	24.8	24.8	6
12	120	29.76	4.96	6
24	130	32.24	2.48	12

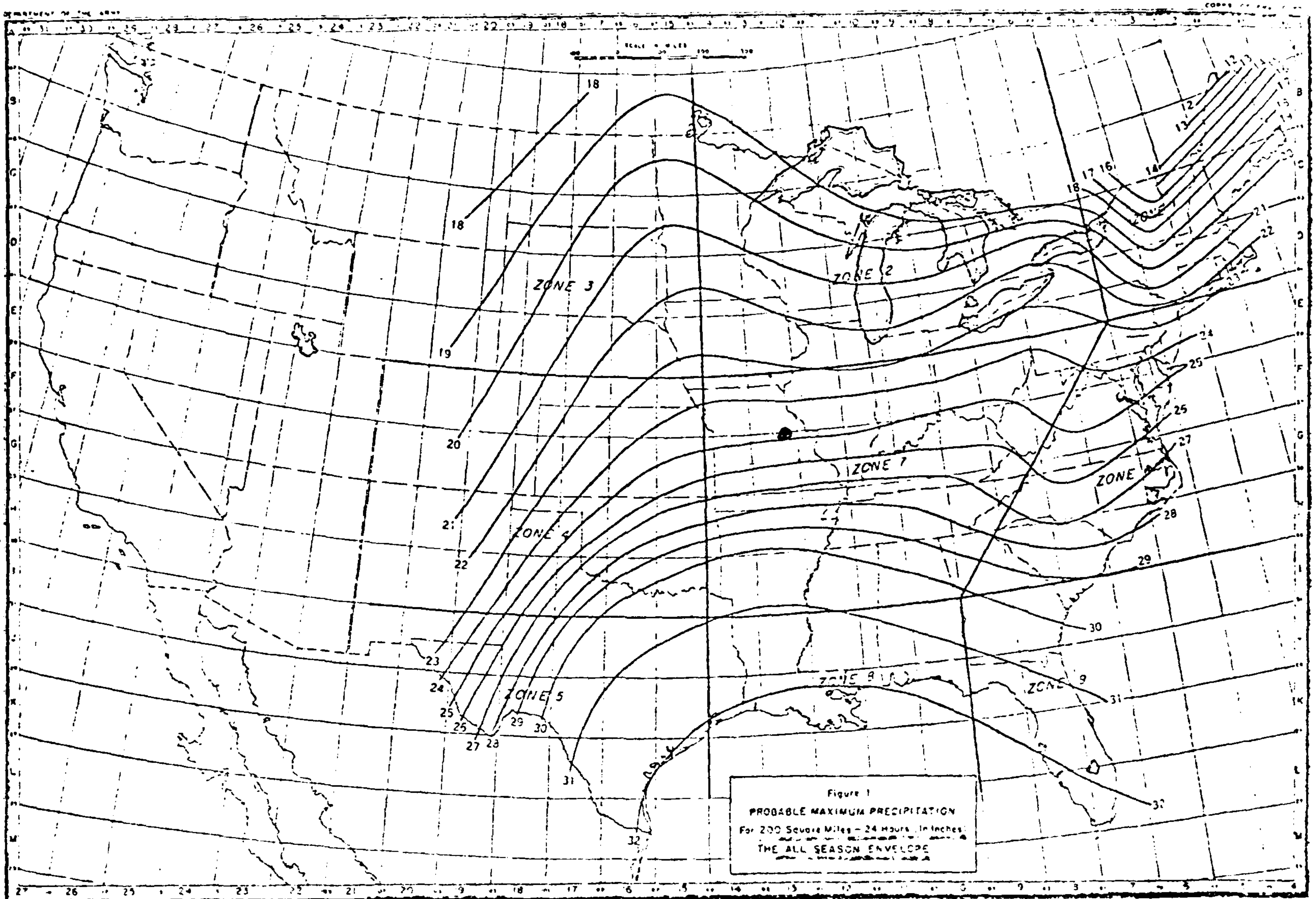


Figure 1
PROBABLE MAXIMUM PRECIPITATION
For 200 Square Miles – 24 Hours (In Inches)
THE ALL SEASON ENVELOPE

⊕ Location of Basin Centroid

CARL DREYER LAKE DAM (MO 10158)

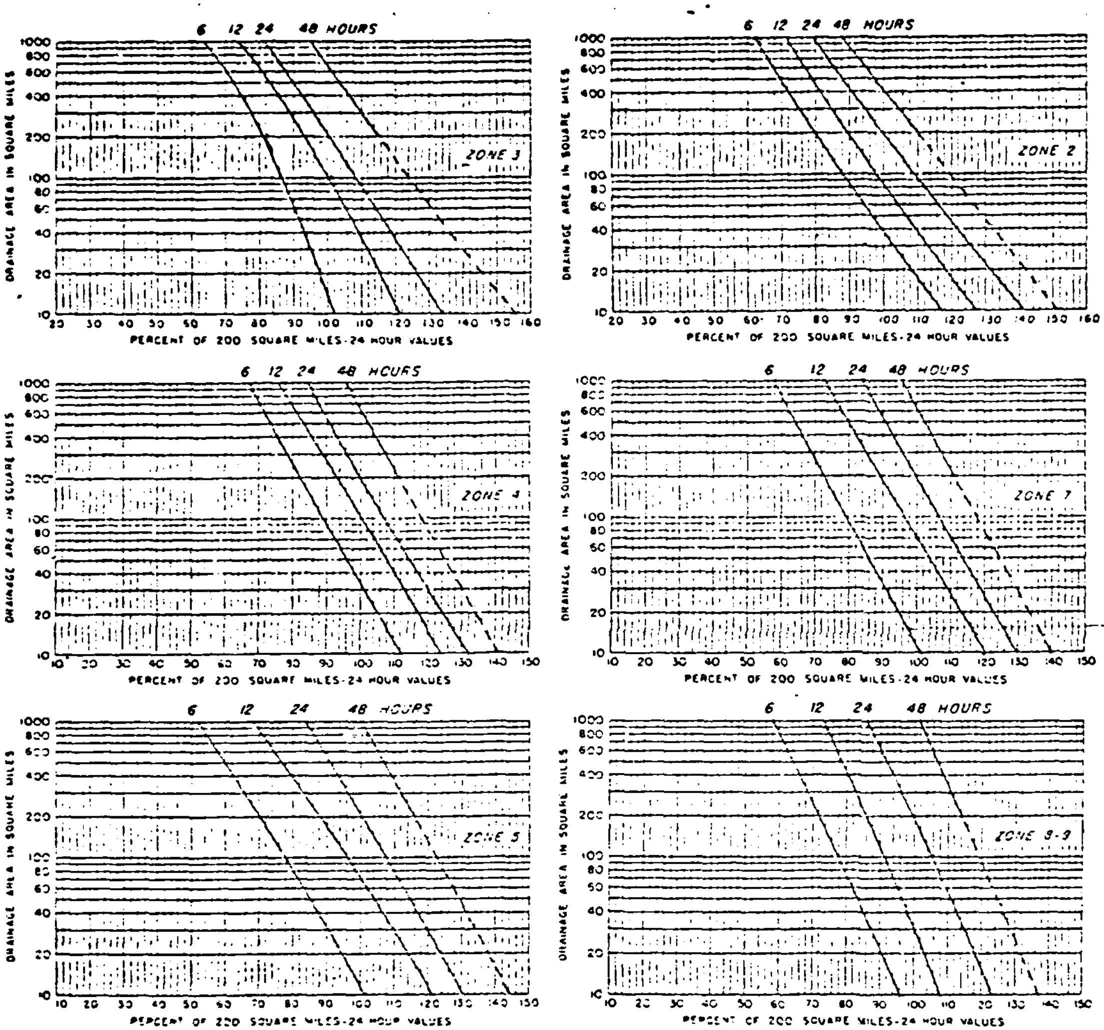


FIGURE 2

SEASONAL VARIATION

DEPTH-AREA-DURATION RELATIONSHIPS

Percentage to be applied to 200 square miles 24 hour probable maximum precipitation values for: THE-ALL SEASON ENVELOPE

PRC ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI 1980 SHEET NO. 1 OF 4
[illegible] CLEVER DAM (NO.10158) JOB NO. 1263
PRINCIPAL SPILLWAY RATING CURVE DEVELOPMENT BY BD DATE 7/11/80

WEIR FLOW:

$D = 19'' = 1.58'$

h/D	$Q/D^{5/2}$	Q	h	W.S. ELEV.
0	0	0	0	804
0.2	0.16	0.50	0.32	804.32
0.4	0.46	1.45	0.63	804.63
0.6	0.88	2.78	0.95	804.95
0.8	1.56	4.92	1.27	805.27
1.0	2.20	6.94	1.58	805.58
1.1	2.50	7.89	1.74	805.74

TRANSISTION BETWEEN WEIR AND PRESSURE FLOW:

$$\frac{h}{D} = 1.1 + 0.025\left(\frac{Q}{D^{5/2}} - 2.5\right), \quad D = 1.58 \therefore$$

$$Q = 79.44h - 130.2$$

W.S. ELEV.	h	Q
805.74	1.74	8.03
806	2.0	28.68
806.2	2.2	44.57
806.4	2.4	60.46
806.6	2.6	76.34
806.8	2.8	92.23
807	3.0	108.12

PRESSURE FLOW:

$$Q = A\sqrt{\frac{2gH}{\Sigma K}} \quad ; \quad K_{entrance} = 1.0$$

$$K_{exit} = 1.0$$

$$K_{friction} = \frac{29.1 n^2 L}{R^{4/3}} = \frac{29.1(0.012)^2(110)}{\left(\frac{1.58}{4}\right)^{4/3}} = 1.59$$

$$\Sigma K = 3.59$$

PRC ENGINEERING CONSULTANTS, INC.

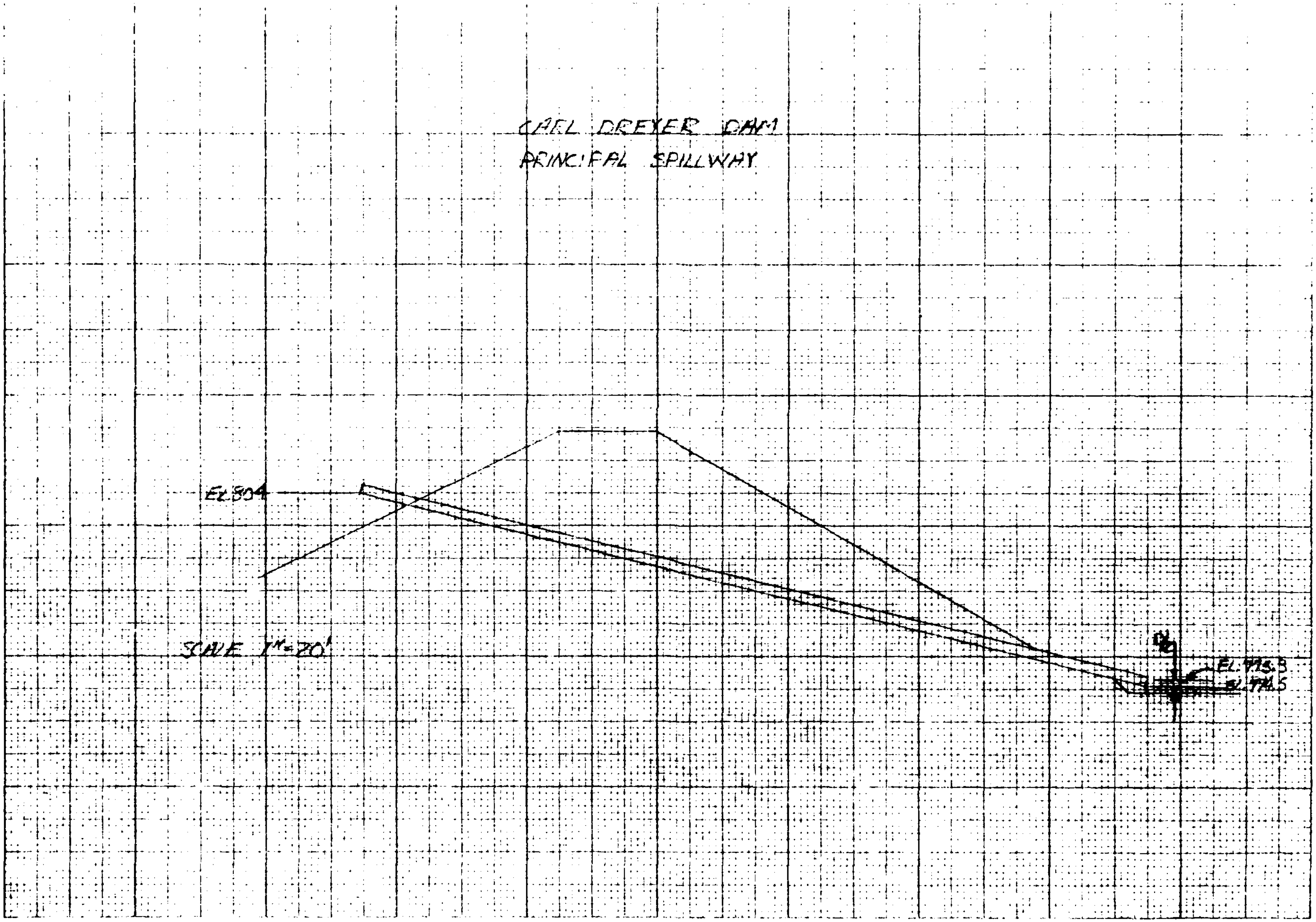
DAM SAFETY INSPECTION / MISSOURI 1980 SHEET NO. 2 OF 4

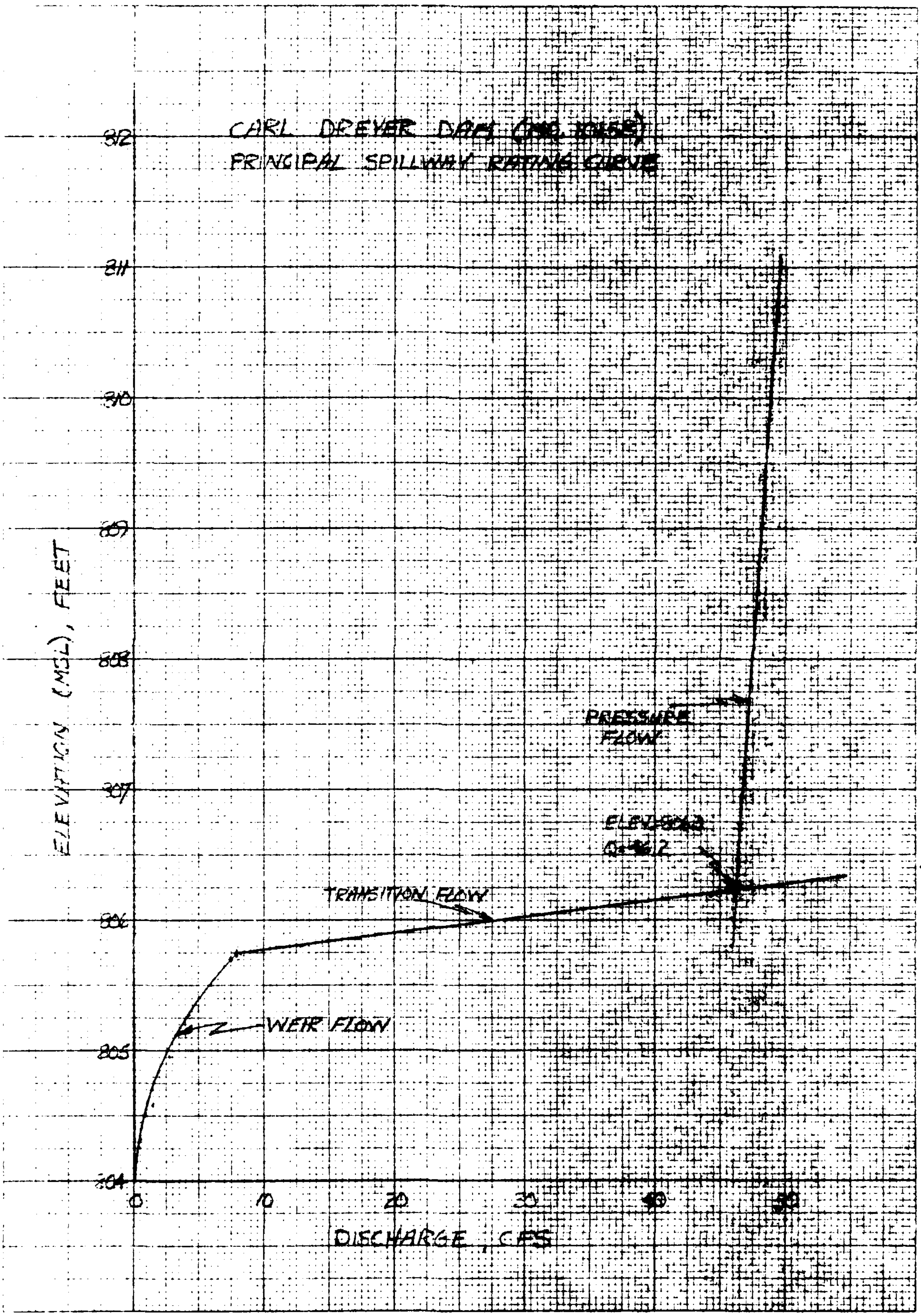
CARL DREYER DAM (MO. 10158) JOB NO. 1263

PRINCIPAL SPILLWAY RATING CURVE DEVELOPMENT BY BD DATE 7/11/80

$$Q = 1.96\sqrt{\frac{2gH}{3.29}} = 8.30\sqrt{H}$$; where H = W.S. ELEV - 775.3

W.S. ELEV.	H	Q
805.7	30.4	45.8
806	30.7	46.0
806.2	30.9	46.1
806.4	31.1	46.3
806.6	31.3	46.4
806.8	31.5	46.6
807	31.7	46.7
807.2	31.9	46.9
809	33.7	48.2
811	35.7	49.6


CARL DREYER DAM
PRINCIPAL SPILLWAY
EL 804
SCALE 1"=20'
EL 775.8
EL 774.5

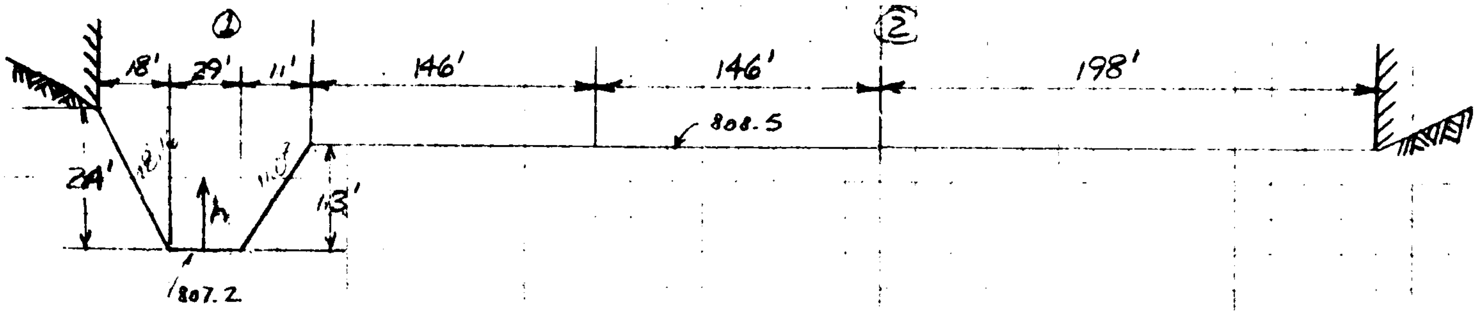

CARL DREYER DAM
PRINCIPAL SPILLWAY RATING CURVE
ELEVATION (MSL), FEET
DISCHARGE, CFS
812
811
810
809
808
807
806
805
804
0
10
20
30
40
50
PRESSURE FLOW
TRANSITION FLOW
WEIR FLOW

PRC ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION/MISSOURI-1980 SHEET NO. 1 OF 4

CARL DREYER DAM (MO. 10158) JOB NO. 1263

EMERGENCY SPILLWAY AND OVERTOP RATING CURVE BY BD DATE 7/8/80



AREA ①:

for $y_{c_1} < 1.3'$, $T_1 = 15.96h + 29$

$A = 7.98h^2 + 29h$

for $1.3' < y_{c_1} < 2.4'$; $A = h(7.5h + 40 - h(\frac{18}{4.8})) - \frac{11(1.3)}{2} = h(3.75h + 40) - 7.15$

$T = 29 + 11 + h(\frac{18}{2.4}) = 7.5h + 40$

for $h > 2.4'$; $T = 29 + 11 + 18 = 58'$

$A = 58h - 28.75$

AREA 2:

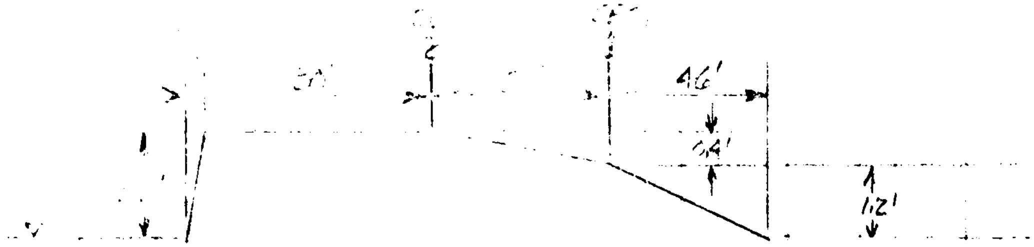
h_2 = W.S. ELEV. - 808.5

PRC ENGINEERING CONSULTANTS, INC.

[illegible] SAFETY INSPECTION- MISSOURI 1980 SHEET NO. 2 OF 3

[illegible] DREYER DAM (MO. 10158) JOB NO. 1263

EMERGENCY SPILLWAY AND OVERTOP RATING CURVE BY BD DATE 7/10/80



Results of the HEC 2 program for Section 3 follow:

h	A	T	V	Q_1	h_v	H	W.S. ELEV.	H_2	C_2	L_2	$Q_2=C_2L_2H_2^{1.5}$	$Q_T=Q_1+Q_2$
[illegible]	[illegible]	34.25	0.96	10	0.01	0.34	807.54	—	—	490	—	10
[illegible]	[illegible]	40.75	1.98	50	0.06	0.79	807.99	—	—	490	—	50
0.89	[illegible]	[illegible]	2.30	75	0.09	0.98	808.17	—	—	490	—	75
[illegible]	[illegible]	[illegible]	2.44	100	0.11	1.12	808.33	—	—	490	—	100
1.14	[illegible]	47.20	2.88	125	0.13	1.27	808.47	—	—	490	—	125
1.25	48.63	48.92	3.08	150	0.15	1.40	808.60	0.10	2.93	490	45	195
1.35	53.55	50.16	3.27	175	0.17	1.52	808.71	0.21	2.97	490	140	315
1.43	57.90	50.75	3.45	200	0.19	1.62	808.82	0.32	2.99	490	265	465
1.76	74.83	53.20	4.01	300	0.25	2.01	809.21	0.71	3.09	490	905	1205
2.01	[illegible]	55.10	4.52	400	0.32	2.33	809.53	1.03	3.11	490	1593	1993
[illegible]	[illegible]	56.86	4.91	500	0.37	2.62	809.82	1.32	3.13	490	2324	2824
[illegible]	[illegible]	[illegible]	5.25	600	0.43	2.89	810.09	1.59	3.14	490	3084	3684
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.48	[illegible]	[illegible]	[illegible]	[illegible]	490	3851	4551
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.07	3.16	490	4667	5407

ECI-4 PRC ENGINEERING CONSULTANTS INC.

Dam Safety Inspection / Missouri - 1980 SHEET NO. 1 OF 1

Dreyer Dam (Mo 10158) JOB NO. 1263

Check slope in emergency spillway BY JFK DATE 9/16/80

$Slope_{bed} = 0.4/50 = 0.008$

$$S_c = \left[\frac{Q\,n}{1.49} \frac{1}{A} \frac{1}{R^{2/3}} \right]^2$$

for $y = 1.3$, $Q = 294.6$
$A = 51.19$
$R = 1.03$

$$S_c = \left[\frac{294.6(0.027)}{1.49} \frac{1}{51.19} \frac{1}{1.03^{2/3}} \right]^2 = 0.0105 > 0.008$$ ∴ slope is mild

$Slope_{bed} = 1.2/4.6 = 0.261$

$S_c = 0.0105 < 0.261$ ∴ slope is steep

Conclusion: Use HEC-2 to make a backwater analysis of the 30' of level crest in the spillway and the first 50' of the discharge channel.

PRC ENGINEERING CONSULTANTS, INC.

[illegible] INSPECTION / MISSOURI MSD — SHEET NO 1 OF 2

[illegible] DREYER DAM (MO. 10158) — JOB NO. 1263

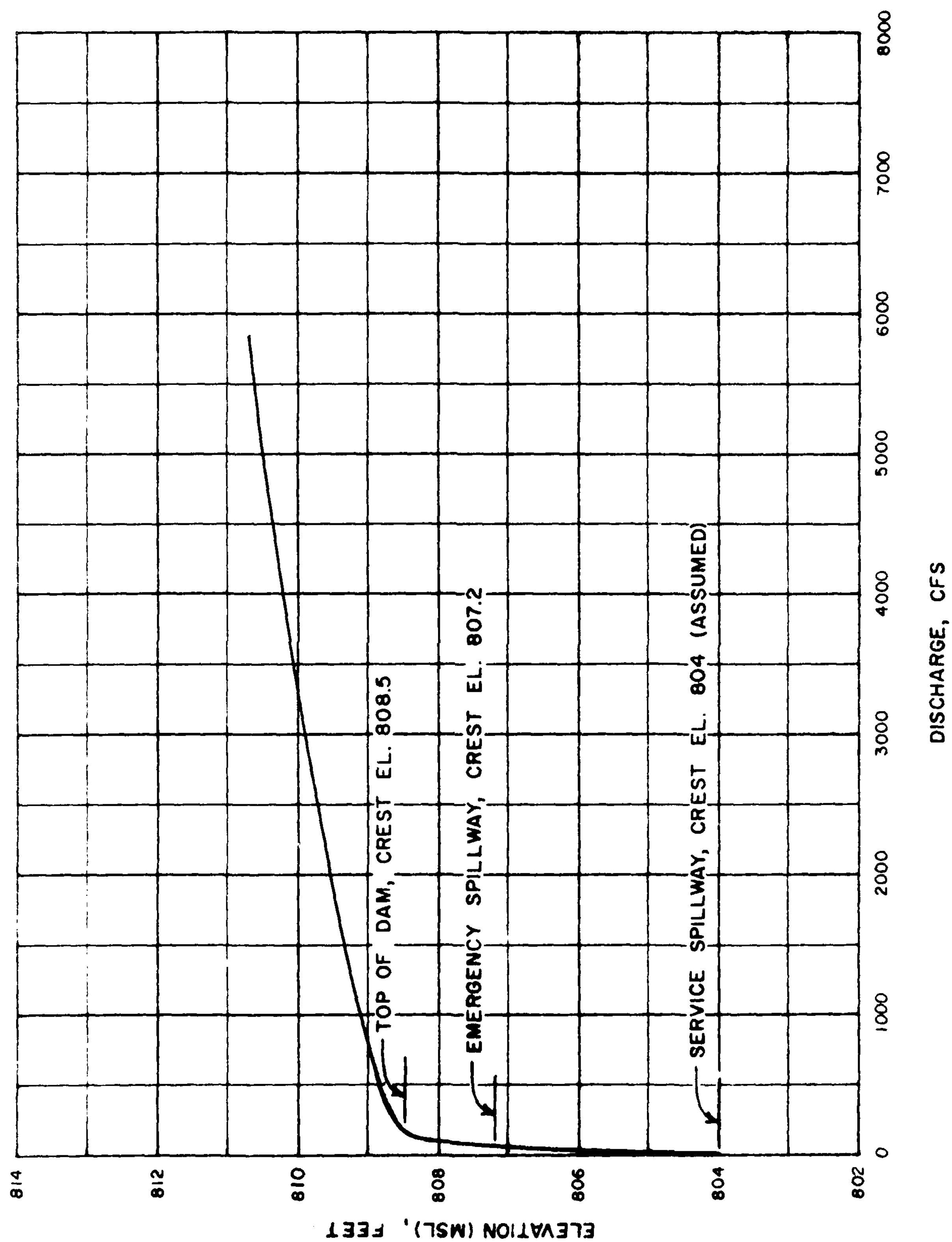
COMBINED RATING CURVE — BY BD — DATE 7/11/80

W.S. ELEV.	h or H	Q_1 PRINCIPAL SPILLWAY	Q_2 EMERGENCY SPILLWAY AND OVERTOP	$Q_{TOTAL} = Q_1 + Q_2$
804.0	0	0 [1]	0	0
805.7	1.7	8 [1]	0	8
806.0	2.0	29 [2]	0	29
806.3	31.0	46	0	46
807.0	31.7	47	0	47
807.2	31.9	47	0	47
807.5	32.2	47	10	57
808.0	32.7	47	50	97
808.2	32.9	48	75	123
808.3	33.0	48	100	148
808.5	33.2	48	125	173
808.6	33.3	48	195	243
808.7	33.4	48	315	363
808.8	33.5	48	465	513
809.2	33.9	48	1205	1253
809.5	34.2	49	1993	2042
809.8	34.5	49	2824	2873
810.1	34.8	49	3684	3733
810.3	35.0	49	4551	4600
810.6	35.3	49	5407	5456

[1] Weir flow controls: $h = \text{W.S. ELEV.} - 804$

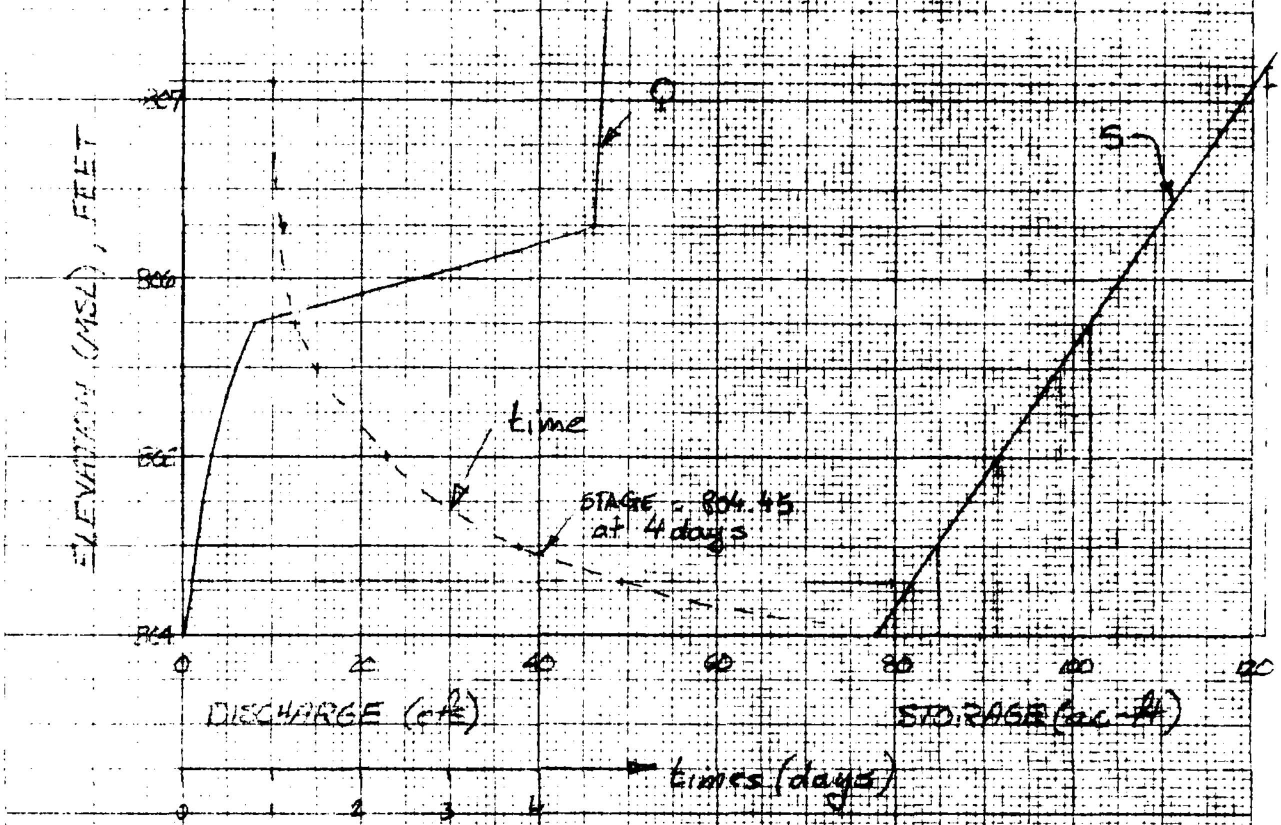
[2] Transition flow: $h = \text{W.S. ELEV} - 804$; $Q = 79.44h - 130.2$

[3] Pressure flow at and above el. 806.3: $H = \text{W.S. EL.} - 775.3$; $Q = 8.30\sqrt{H}$



CARL DREYER LAKE DAM (MO. 10158)
SPILLWAY AND OVERTOP RATING CURVE

DAM SAFETY INSPECTIONS / MISSOURI 1980
CARL SCTYER DAM (MO 10158)
STARTING WATER SURFACE ELEV. FOR PMF



ELEVATION	AVE. DISCHARGE (cfs)	Δ STORAGE (ac-ft)	Δ TIME (days)	Σ TIME (days)
807.1				
	46.5	11.0	0.12	0.12
806.3				
	28.5	7.0	0.12	0.24
805.75				
	7.0	3.0	0.25	0.49
805.5				
	4.5	7.0	0.78	1.27
805				
	2.2	6.5	1.49	2.76
804.5				
	1.3	3.0	1.16	3.92
804.3				
	0.5	4.0	4.03	[illegible]
804.0				

HEC1DB PMF INPUT DATA

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************
A1                       DAM SAFETY INSPECTION - MISSOURI
A2                         CARL DREYER DAM (MO.10159)
A3                          PMF STARTING AT 804.45
B     300      0      5      0      0      0      0      0      0      0
B1      5
J       1      1      1
J1      1
K       0  10158                                    1
K1   INPUT RUNOFF PARAMETERS
M       1      2   .313          .313      1                    1
P           24.8    100    120    130
T                                               -1    -93
W2            .17
X                           1
K       1  10156                                    1
K1   ROUTE HYDROGRAPH THROUGH CARL DREYER RESERVOIR
Y                           1      1
Y1      1                                  -804.45     -1
Y4  804.0  805.7  806.0  806.3  807.0  807.2  807.5  808.0  808.2  808.3
Y4  808.5  808.6  808.7  808.9  809.0  809.5  809.8  810.1  810.3  810.6
Y5      0      8     29     46     47     47     57     97    123    145
Y5    173    243    363    513   1253   2042   2873   3733   4600   5456
$A             7     11     15     18     20     45
$E    782    800    804  807.0  808.5    810    820
$S    804
$D  809.5
K      99
```

INFLOW PMF HYDROGRAPH

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	10158
ROUTE HYDROGRAPH TO	10158
END OF NETWORK	

```
**************************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**************************************

RUN DATE* 80/07/2.
    TIME* 08.32.20.

                    DAM SAFETY INSPECTION - MISSOURI
                     CARL DREYER DAM (MO.10158)
                      PMF STARTING AT 804.45

                          JOB SPECIFICATION
     NQ     NHR    NMIN    IDAY    IHR    IMIN   METRC    IPLT    IPRT   NSTAN
    300       0       5       0      0       0       0       0       0       0
                           JOPER    NWT   LROPT   TRACE
                              5       0       0       0

                   MULTI-PLAN ANALYSES TO BE PERFORMED
                     NPLAN= 1 NRTIO= 1 LRTIO= 1
          RTIOS=    1.00

  **********     **********     **********     **********     **********

                     SUB-AREA RUNOFF COMPUTATION

        INPUT RUNOFF PARAMETERS

           ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
           10158       0       0       0       0       0       1       0       0

                            HYDROGRAPH DATA
     IHYDG   IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
         1      2     .31    0.00     .31    1.00   0.000       0       1       0

                             PRECIP DATA
           SPFE     PMS      R6     R12     R24     R48     R72     R96
           0.00   24.80  100.00  120.00  130.00    0.00    0.00    0.00

                              LOSS DATA
    LROPT  STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
        0   0.00    0.00    1.00    0.00    0.00    1.00   -1.00  -93.00    0.00    0.00

        CURVE NO = -93.00  WETNESS =   -1.00  EFFECT CN =  93.00

                          UNIT HYDROGRAPH DATA
                      TC=  0.00     LAG=   .17

                            RECESSION DATA
            STRTQ=    0.00   QRCSN=   0.00   RTIOR= 1.00

     UNIT HYDROGRAPH 12 END OF PERIOD ORDINATES, TC=   0.00 HOURS, LAG=   .17  VOL= 1.00
      217.    689.    675.    423.    212.    114.    65.    31.    17.    9.
        5.      2.
```

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.	1.01	12.35	151	.21	.20	.00	487.
1.01	.10	2	.01	0.00	.01	0.	1.01	12.40	152	.21	.20	.00	491.
1.01	.15	3	.01	0.00	.01	0.	1.01	12.45	153	.21	.20	.00	494.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.50	154	.21	.21	.00	495.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.55	155	.21	.21	.00	496.
1.01	.30	6	.01	0.00	.01	0.	1.01	13.00	156	.21	.21	.00	497.
1.01	.35	7	.01	0.00	.01	0.	1.01	13.05	157	.25	.25	.00	506.
1.01	.40	8	.01	0.00	.01	0.	1.01	13.10	158	.25	.25	.00	533.
1.01	.45	9	.01	0.00	.01	0.	1.01	13.15	159	.25	.25	.00	561.
1.01	.50	10	.01	0.00	.01	0.	1.01	13.20	160	.25	.25	.00	578.
1.01	.55	11	.01	.00	.01	0.	1.01	13.25	161	.25	.25	.00	587.
1.01	1.00	12	.01	.00	.01	0.	1.01	13.30	162	.25	.25	.00	592.
1.01	1.05	13	.01	.00	.01	0.	1.01	13.35	163	.25	.25	.00	595.
1.01	1.10	14	.01	.00	.01	1.	1.01	13.40	164	.25	.25	.00	596.
1.01	1.15	15	.01	.00	.01	2.	1.01	13.45	165	.25	.25	.00	597.
1.01	1.20	16	.01	.00	.01	3.	1.01	13.50	166	.25	.25	.00	598.
1.01	1.25	17	.01	.00	.01	4.	1.01	13.55	167	.25	.25	.00	598.
1.01	1.30	18	.01	.00	.01	5.	1.01	14.00	168	.25	.25	.00	598.
1.01	1.35	19	.01	.00	.01	6.	1.01	14.05	169	.31	.31	.00	612.
1.01	1.40	20	.01	.00	.01	[illegible]	1.01	14.10	170	.31	.31	.00	652.
1.01	1.45	21	.01	.00	.01	7.	1.01	14.15	171	.31	.31	.00	694.
1.01	1.50	22	.01	.00	.01	8.	1.01	14.20	172	.31	.31	.00	720.
1.01	1.55	23	.01	.00	.01	9.	1.01	14.25	173	.31	.31	.00	734.
1.01	2.00	24	.01	.00	.01	10.	1.01	14.30	174	.31	.31	.00	741.
1.01	2.05	25	.01	.00	.01	11.	1.01	14.35	175	.31	.31	.00	745.
1.01	2.10	26	.01	.01	.01	11.	1.01	14.40	176	.31	.31	.00	747.
1.01	2.15	27	.01	.01	.01	12.	1.01	14.45	177	.31	.31	.00	748.
1.01	2.20	28	.01	.01	.01	12.	1.01	14.50	178	.31	.31	.00	748.
1.01	2.25	29	.01	.01	.01	13.	1.01	14.55	179	.31	.31	.00	749.
1.01	2.30	30	.01	.01	.01	14.	1.01	15.00	180	.31	.31	.00	749.
1.01	2.35	31	.01	.01	.01	14.	1.01	15.05	181	.19	.19	.00	723.
1.01	2.40	32	.01	.01	.01	15.	1.01	15.10	182	.38	.38	.00	684.
1.01	2.45	33	.01	.01	.01	15.	1.01	15.15	183	.38	.38	.00	726.
1.01	2.50	34	.01	.01	.01	16.	1.01	15.20	184	.57	.56	.00	842.
1.01	2.55	35	.01	.01	.01	16.	1.01	15.25	185	.66	.66	.00	1040.
1.01	3.00	36	.01	.01	.01	17.	1.01	15.30	186	1.60	1.60	.00	1460.
1.01	3.05	37	.01	.01	.01	17.	1.01	15.35	187	2.64	2.64	.00	2460.
1.01	3.10	38	.01	.01	.01	17.	1.01	15.40	188	1.04	1.04	.00	3517.
1.01	3.15	39	.01	.01	.01	18.	1.01	15.45	189	.66	.66	.00	3527.
1.01	3.20	40	.01	.01	.01	18.	1.01	15.50	190	.57	.56	.00	2841.
1.01	3.25	41	.01	.01	.01	19.	1.01	15.55	191	.38	.38	.00	2146.
1.01	3.30	42	.01	.01	.01	19.	1.01	16.00	192	.38	.38	.00	1640.
1.01	3.35	43	.01	.01	.01	19.	1.01	16.05	193	.29	.29	.00	1288.
1.01	3.40	44	.01	.01	.01	20.	1.01	16.10	194	.29	.29	.00	1042.
1.01	3.45	45	.01	.01	.01	20.	1.01	16.15	195	.29	.29	.00	886.
1.01	3.50	46	.01	.01	.01	20.	1.01	16.20	196	.29	.29	.00	[illegible]
1.01	3.55	47	.01	.01	.01	20.	1.01	16.25	197	.29	.29	.00	751.
1.01	4.00	48	.01	.01	.00	21.	1.01	16.30	198	.29	.29	.00	725.
1.01	4.05	49	.01	.01	.00	21.	1.01	16.35	199	.29	.29	.00	710.
1.01	4.10	50	.01	.01	.00	21.	1.01	16.40	200	.29	.29	.00	705.
1.01	4.15	51	.01	.01	.00	22.	1.01	16.45	201	.29	.29	.00	702.
1.01	4.20	52	.01	.01	.00	22.	1.01	16.50	202	.29	.29	.00	701.
1.01	4.25	53	.01	.01	.00	22.	1.01	16.55	203	.29	.29	.00	701.
1.01	4.30	54	.01	.01	.00	22.	1.01	17.00	204	.29	.29	.00	700.
1.01	4.35	55	.01	.01	.00	23.	1.01	17.05	205	.23	.23	.00	687.
1.01	4.40	56	.01	.01	.00	23.	1.01	17.10	206	.23	.23	.00	646.

1.01	4.45	57	.01	.01	.00	23.	1.01	17.15	207	.23	.23	.00	504.
1.01	4.50	58	.01	.01	.00	23.	1.01	17.20	208	.23	.23	.00	578.
1.01	4.55	59	.01	.01	.00	23.	1.01	17.25	209	.23	.23	.00	565.
1.01	5.00	60	.01	.01	.00	24.	1.01	17.30	210	.23	.23	.00	558.
1.01	5.05	61	.01	.01	.00	24.	1.01	17.35	211	.23	.23	.00	554.
1.01	5.10	62	.01	.01	.00	24.	1.01	17.40	212	.23	.23	.00	552.
1.01	5.15	63	.01	.01	.00	24.	1.01	17.45	213	.23	.23	.00	551.
1.01	5.20	64	.01	.01	.00	24.	1.01	17.50	214	.23	.23	.00	551.
1.01	5.25	65	.01	.01	.00	24.	1.01	17.55	215	.23	.23	.00	551.
1.01	5.30	66	.01	.01	.00	25.	1.01	18.00	216	.23	.23	.00	550.
1.01	5.35	67	.01	.01	.00	25.	1.01	18.05	217	.02	.02	.00	506.
1.01	5.40	68	.01	.01	.00	25.	1.01	18.10	218	.02	.02	.00	370.
1.01	5.45	69	.01	.01	.00	25.	1.01	18.15	219	.02	.02	.00	230.
1.01	5.50	70	.01	.01	.00	25.	1.01	18.20	220	.02	.02	.00	105.
1.01	5.55	71	.01	.01	.00	25.	1.01	18.25	221	.02	.02	.00	99.
1.01	6.00	72	.01	.01	.00	26.	1.01	18.30	222	.02	.02	.00	78.
1.01	6.05	73	.07	.05	.01	35.	1.01	18.35	223	.02	.02	.00	63.
1.01	6.10	74	.07	.06	.01	69.	1.01	18.40	224	.02	.02	.00	57.
1.01	6.15	75	.07	.06	.01	94.	1.01	18.45	225	.02	.02	.00	53.
1.01	6.20	76	.07	.06	.01	115.	1.01	18.50	226	.02	.02	.00	51.
1.01	6.25	77	.07	.06	.01	120.	1.01	18.55	227	.02	.02	.00	50.
1.01	6.30	78	.07	.06	.01	132.	1.01	19.00	228	.02	.02	.00	50.
1.01	6.35	79	.07	.06	.01	137.	1.01	19.05	229	.02	.02	.00	50.
1.01	6.40	80	.07	.06	.01	140.	1.01	19.10	230	.02	.02	.00	50.
1.01	6.45	81	.07	.06	.01	142.	1.01	19.15	231	.02	.02	.00	50.
1.01	6.50	82	.07	.06	.01	145.	1.01	19.20	232	.02	.02	.00	50.
1.01	6.55	83	.07	.06	.01	146.	1.01	19.25	233	.02	.02	.00	50.
1.01	7.00	84	.07	.06	.01	148.	1.01	19.30	234	.02	.02	.00	50.
1.01	7.05	85	.07	.06	.01	149.	1.01	19.35	235	.02	.02	.00	50.
1.01	7.10	86	.07	.06	.01	150.	1.01	19.40	236	.02	.02	.00	50.
1.01	7.15	87	.07	.06	.01	151.	1.01	19.45	237	.02	.02	.00	50.
1.01	7.20	88	.07	.06	.01	152.	1.01	19.50	238	.02	.02	.00	50.
1.01	7.25	89	.07	.06	.01	153.	1.01	19.55	239	.02	.02	.00	50.
1.01	7.30	90	.07	.06	.00	153.	1.01	20.00	240	.02	.02	.00	50.
1.01	7.35	91	.07	.06	.00	154.	1.01	20.05	241	.02	.02	.00	50.
1.01	7.40	92	.07	.06	.00	155.	1.01	20.10	242	.02	.02	.00	50.
1.01	7.45	93	.07	.06	.00	155.	1.01	20.15	243	.02	.02	.00	50.
1.01	7.50	94	.07	.06	.00	156.	1.01	20.20	244	.02	.02	.00	50.
1.01	7.55	95	.07	.06	.00	156.	1.01	20.25	245	.02	.02	.00	50.
1.01	8.00	96	.07	.07	.00	157.	1.01	20.30	246	.02	.02	.00	50.
1.01	8.05	97	.07	.07	.00	157.	1.01	20.35	247	.02	.02	.00	50.
1.01	8.10	98	.07	.07	.00	158.	1.01	20.40	248	.02	.02	.00	50.
1.01	8.15	99	.07	.07	.00	158.	1.01	20.45	249	.02	.02	.00	50.
1.01	8.20	100	.07	.07	.00	158.	1.01	20.50	250	.02	.02	.00	50.
1.01	8.25	101	.07	.07	.00	159.	1.01	20.55	251	.02	.02	.00	50.
1.01	8.30	102	.07	.07	.00	159.	1.01	21.00	252	.02	.02	.00	50.
1.01	8.35	103	.07	.07	.00	159.	1.01	21.05	253	.02	.02	.00	50.
1.01	8.40	104	.07	.07	.00	160.	1.01	21.10	254	.02	.02	.00	50.
1.01	8.45	105	.07	.07	.00	160.	1.01	21.15	255	.02	.02	.00	50.
1.01	8.50	106	.07	.07	.00	160.	1.01	21.20	256	.02	.02	.00	50.
1.01	8.55	107	.07	.07	.00	160.	1.01	21.25	257	.02	.02	.00	50.
1.01	9.00	108	.07	.07	.00	161.	1.01	21.30	258	.02	.02	.00	50.
1.01	9.05	109	.07	.07	.00	161.	1.01	21.35	259	.02	.02	.00	50.
1.01	9.10	110	.07	.07	.00	161.	1.01	21.40	260	.02	.02	.00	50.
1.01	9.15	111	.07	.07	.00	161.	1.01	21.45	261	.02	.02	.00	50.
1.01	9.20	112	.07	.07	.00	161.	1.01	21.50	262	.02	.02	.00	50.
1.01	9.25	113	.07	.07	.00	162.	1.01	21.55	263	.02	.02	.00	50.
1.01	9.30	114	.07	.07	.00	162.	1.01	22.00	264	.02	.02	.00	50.
1.01	9.35	115	.07	.07	.00	162.	1.01	22.05	265	.02	.02	.00	50.
1.01	9.40	116	.07	.07	.00	162.	1.01	22.10	266	.02	.02	.00	50.

1.01	9.45	117	.07	.07	.00	162.		1.01	22.15	267	.02	.02	.00	50.
1.01	9.50	118	.07	.07	.00	162.		1.01	22.20	268	.02	.02	.00	50.
1.01	9.55	119	.07	.07	.00	162.		1.01	22.25	269	.02	.02	.00	50.
1.01	10.00	120	.07	.07	.00	163.		1.01	22.30	270	.02	.02	.00	50.
1.01	10.05	121	.07	.07	.00	163.		1.01	22.35	271	.02	.02	.00	50.
1.01	10.10	122	.07	.07	.00	163.		1.01	22.40	272	.02	.02	.00	50.
1.01	10.15	123	.07	.07	.00	163.		1.01	22.45	273	.02	.02	.00	50.
1.01	10.20	124	.07	.07	.00	163.		1.01	22.50	274	.02	.02	.00	50.
1.01	10.25	125	.07	.07	.00	163.		1.01	22.55	275	.02	.02	.00	50.
1.01	10.30	126	.07	.07	.00	163.		1.01	23.00	276	.02	.02	.00	50.
1.01	10.35	127	.07	.07	.00	163.		1.01	23.05	277	.02	.02	.00	50.
1.01	10.40	128	.07	.07	.00	163.		1.01	23.10	278	.02	.02	.00	50.
1.01	10.45	129	.07	.07	.00	164.		1.01	23.15	279	.02	.02	.00	50.
1.01	10.50	130	.07	.07	.00	164.		1.01	23.20	280	.02	.02	.00	50.
1.01	10.55	131	.07	.07	.00	164.		1.01	23.25	281	.02	.02	.00	50.
1.01	11.00	132	.07	.07	.00	164.		1.01	23.30	282	.02	.02	.00	50.
1.01	11.05	133	.07	.07	.00	164.		1.01	23.35	283	.02	.02	.00	50.
1.01	11.10	134	.07	.07	.00	164.		1.01	23.40	284	.02	.02	.00	50.
1.01	11.15	135	.07	.07	.00	164.		1.01	23.45	285	.02	.02	.00	50.
1.01	11.20	136	.07	.07	.00	164.		1.01	23.50	286	.02	.02	.00	50.
1.01	11.25	137	.07	.07	.00	164.		1.01	23.55	287	.02	.02	.00	50.
1.01	11.30	138	.07	.07	.00	164.		1.02	0.00	288	.02	.02	.00	50.
1.01	11.35	139	.07	.07	.00	164.		1.02	.05	289	0.00	0.00	0.00	46.
1.01	11.40	140	.07	.07	.00	164.		1.02	.10	290	0.00	0.00	0.00	32.
1.01	11.45	141	.07	.07	.00	164.		1.02	.15	291	0.00	0.00	0.00	19.
1.01	11.50	142	.07	.07	.00	164.		1.02	.20	292	0.00	0.00	0.00	9.
1.01	11.55	143	.07	.07	.00	165.		1.02	.25	293	0.00	0.00	0.00	5.
1.01	12.00	144	.07	.07	.00	165.		1.02	.30	294	0.00	0.00	0.00	3.
1.01	12.05	145	.21	.20	.00	194.		1.02	.35	295	0.00	0.00	0.00	1.
1.01	12.10	146	.21	.20	.00	284.		1.02	.40	296	0.00	0.00	0.00	1.
1.01	12.15	147	.21	.20	.00	376.		1.02	.45	297	0.00	0.00	0.00	0.
1.01	12.20	148	.21	.20	.00	433.		1.02	.50	298	0.00	0.00	0.00	0.
1.01	12.25	149	.21	.20	.00	463.		1.02	.55	299	0.00	0.00	0.00	0.
1.01	12.30	150	.21	.20	.00	478.		1.02	1.00	300	0.00	0.00	0.00	0.

SUM 32.24 31.35 .89 75956.
(819.)(796.)(23.)(2150.83)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3527.	825.	264.	253.	75959.
CMS	100.	23.	7.	7.	2151.
INCHES		24.51	31.35	31.35	31.35
MM		622.62	796.39	796.39	796.39
AC-FT		409.	523.	523.	523.
THOUS CU M		504.	645.	645.	645.

HYDROGRAPH AT STA I0156 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	2.	2.	3.	4.	5.	6.	6.
7.	8.	9.	10.	10.	11.	11.	12.	13.	14.
14.	15.	15.	16.	16.	17.	17.	17.	18.	18.
19.	19.	19.	20.	20.	20.	20.	21.	21.	21.
22.	22.	22.	22.	23.	23.	23.	23.	23.	24.
24.	24.	24.	24.	24.	25.	25.	25.	25.	26.
25.	40.	55.	64.	90.	115.	126.	135.	137.	146.
143.	148.	156.	148.	149.	150.	151.	152.	153.	153.
154.	155.	155.	156.	156.	157.	157.	158.	158.	158.
159.	159.	159.	160.	160.	160.	160.	161.	161.	161.

PMF FLOOD ROUTING

AD-A104 610 PRC CONSOER TOWNSEND INC ST LOUIS MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. CARL DREYER LAKE DAM (MO 10158), M--ETC(U)
SEP 80 W G SHIFRIN DACW43-80-C-0094

UNCLASSIFIED NL

2 OF 2
AD
A104610

END
DATE
FILMED
10-81
DTIC

161.	161.	162.	162.	162.	162.	162.	162.	162.	163.
[illegible]	163.	163.	163.	163.	163.	163.	163.	164.	164.
164.	164.	164.	164.	164.	164.	164.	164	164.	164.
164.	164.	165.	165.	194.	284.	376.	433.	463.	478.
467.	491.	494.	495.	496.	497.	506.	533.	561.	578.
547.	592.	595.	596.	597.	598.	598.	599.	612.	652.
694.	720.	734.	741.	745.	747.	748.	748.	749.	749.
723.	664.	726.	842.	1040.	1460.	2460.	3517.	3527.	2841.
2146.	1640.	1288.	1042.	[illegible]	797.	751.	725.	710.	705.
702.	701.	701.	700.	687.	646.	604.	578.	565.	558.
554.	552.	55[illegible].	551.	551.	560.	506.	370.	230.	143.
99.	76.	63.	57.	53.	51.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.	50.	50.
50.	50.	50.	50.	50.	50.	50.	50.	46.	32.
18.	9.	5.	3.	1.	1.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3527.	[illegible]	264.	253.	[illegible]
CMS	100.	23.	7.	7.	[illegible]
INCHES		24.51	31.35	31.35	31.35
MM		622.62	796.39	796.39	796.39
AC-FT		[illegible]	523.	523.	523.
THOUS CU M		504.	645.	645.	645.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH CARL DREYER RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
10158	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-804.	-1

STAGE	804.00	805.70	806.00	806.30	807.00	807.20	807.50	808.00	808.20
	808.40	808.60	808.70	808.80	809.20	809.50	809.90	810.10	810.50
FLOW	0.00	6.00	29.00	46.00	47.00	47.00	57.00	91.00	121.00
	173.00	243.00	363.00	513.00	1253.00	2042.00	2873.00	3733.00	4600.00

SURFACE AREA= 0. 11. 15. 18. 20. 45.

CAPACITY= 0. 42. 78. 119. 141. 164. 486.

ELEVATION= 782. 800. 804. 807. 809. 813. 820.

CREL SPWID COQW EXPW ELEVL COQL CAREA EXPL

804. 0.0 .0 .0 0.0 840 0.0 0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
808.0	3.0	0.0	0.

STATION 101FP, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

MO.DA	HR.MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1.01	.05	1	.08	0.	2.	83.	804.4
1.01	.10	2	.17	0.	2.	83.	804.4
1.01	.15	3	.25	0.	2.	83.	804.4
1.01	.20	4	.33	0.	2.	83.	804.4
1.01	.25	5	.42	0.	2.	83.	804.4
1.01	.30	6	.50	0.	2.	83.	804.4
1.01	.35	7	.58	0.	2.	83.	804.4
1.01	.40	8	.67	0.	2.	83.	804.4
1.01	.45	9	.75	0.	2.	83.	804.4
1.01	.50	10	.83	0.	2.	83.	804.4
1.01	.55	11	.92	0.	2.	83.	804.4
1.01	1.00	12	1.00	0.	2.	83.	804.4
1.01	1.05	13	1.08	0.	2.	83.	804.4
1.01	1.10	14	1.17	1.	2.	83.	804.4
1.01	1.15	15	1.25	2.	2.	83.	804.4
1.01	1.20	16	1.33	3.	2.	83.	804.4
1.01	1.25	17	1.42	4.	2.	83.	804.4
1.01	1.30	18	1.50	5.	2.	83.	804.4
1.01	1.35	19	1.58	6.	2.	83.	804.4
1.01	1.40	20	1.67	6.	2.	83.	804.4
1.01	1.45	21	1.75	7.	2.	83.	804.4
1.01	1.50	22	1.83	8.	2.	83.	804.4
1.01	1.55	23	1.92	9.	2.	83.	804.4
1.01	2.00	24	2.00	10.	2.	83.	804.5
1.01	2.05	25	2.08	10.	2.	83.	804.5
1.01	2.10	26	2.17	11.	2.	83.	804.5
1.01	2.15	27	2.25	12.	2.	83.	804.5
1.01	2.20	28	2.33	12.	2.	83.	804.5
1.01	2.25	29	2.42	13.	2.	83.	804.5
1.01	2.30	30	2.50	14.	2.	83.	804.5
1.01	2.35	31	2.58	14.	2.	83.	804.5
1.01	2.40	32	2.67	15.	2.	83.	804.5
1.01	2.45	33	2.75	15.	2.	83.	804.5
1.01	2.50	34	2.83	16.	2.	84.	804.5
1.01	2.55	35	2.92	16.	2.	84.	804.5
1.01	3.00	36	3.00	17.	3.	84.	804.5
1.01	3.05	37	3.08	17.	3.	84.	804.5
1.01	3.10	38	3.17	17.	3.	84.	804.5
1.01	3.15	39	3.25	18.	3.	84.	804.6
1.01	3.20	40	3.33	18.	3.	84.	804.6
1.01	3.25	41	3.42	19.	3.	84.	804.6
1.01	3.30	42	3.50	19.	3.	84.	804.6
1.01	3.35	43	3.58	19.	3.	84.	804.6
1.01	3.40	44	3.67	20.	3.	[illegible]	804.6
1.01	[illegible]	45	3.75	20.	3.	[illegible]	[illegible]
1.01	[illegible]	46	3.83	20.	3.	[illegible]	804.6
1.01	3.55	47	3.92	20.	3.	85.	804.6
1.01	4.00	48	4.00	21.	3.	85.	804.6
1.01	4.05	49	4.08	21.	3.	85.	804.7

1.01	4.10	50	4.17	21.	3.	85.	804.7
1.01	4.15	51	4.25	22.	3.	85.	804.7
1.01	4.20	52	4.33	22.	3.	86.	804.7
1.01	4.25	53	4.42	22.	3.	86.	804.7
1.01	4.30	54	4.50	22.	3.	86.	804.7
1.01	4.35	55	4.58	23.	3.	86.	804.7
1.01	4.40	56	4.67	23.	3.	86.	804.7
1.01	4.45	57	4.75	23.	3.	86.	804.7
1.01	4.50	58	4.83	23.	4.	86.	804.8
1.01	4.55	59	4.92	23.	4.	86.	804.8
1.01	5.00	60	5.00	24.	4.	87.	804.8
1.01	5.05	61	5.08	24.	4.	87.	804.8
1.01	5.10	62	5.17	24.	4.	87.	804.8
1.01	5.15	63	5.25	24.	4.	87.	804.8
1.01	5.20	64	5.33	24.	4.	87.	804.8
1.01	5.25	65	5.42	24.	4.	87.	804.8
1.01	5.30	66	5.50	25.	4.	87.	804.8
1.01	5.35	67	5.58	25.	4.	88.	804.9
1.01	5.40	68	5.67	25.	4.	88.	804.9
1.01	5.45	69	5.75	25.	4.	88.	804.9
1.01	5.50	70	5.83	25.	4.	88.	804.9
1.01	5.55	71	5.92	25.	4.	88.	804.9
1.01	6.00	72	6.00	26.	4.	88.	804.9
1.01	6.05	73	6.08	35.	4.	88.	804.9
1.01	6.10	74	6.17	64.	5.	89.	805.0
1.01	6.15	75	6.25	94.	5.	89.	805.0
1.01	6.20	76	6.33	115.	5.	90.	805.1
1.01	6.25	77	6.42	126.	5.	91.	805.1
1.01	6.30	78	6.50	133.	6.	92.	805.2
1.01	6.35	79	6.58	137.	6.	93.	805.3
1.01	6.40	80	6.67	140.	6.	93.	805.3
1.01	6.45	81	6.75	143.	7.	94.	805.4
1.01	6.50	82	6.83	145.	7.	95.	805.5
1.01	6.55	83	6.92	146.	7.	95.	805.6
1.01	7.00	84	7.00	148.	8.	97.	805.6
1.01	7.05	85	7.08	149.	8.	98.	805.7
1.01	7.10	86	7.17	150.	13.	99.	805.8
1.01	7.15	87	7.25	151.	18.	100.	805.8
1.01	7.20	88	7.33	152.	23.	101.	805.9
1.01	7.25	89	7.42	153.	28.	102.	806.0
1.01	7.30	90	7.50	153.	31.	103.	806.0
1.01	7.35	91	7.58	154.	35.	103.	806.1
1.01	7.40	92	7.67	155.	38.	104.	806.2
1.01	7.45	93	7.75	155.	42.	105.	806.2
1.01	7.50	94	7.83	156.	45.	106.	806.3
1.01	7.55	95	7.92	156.	46.	107.	806.3
1.01	8.00	96	8.00	157.	46.	107.	806.4
1.01	8.05	97	8.08	157.	46.	108.	806.4
1.01	8.10	98	8.17	158.	46.	109.	806.5
1.01	8.15	99	8.25	158.	46.	110.	806.6
1.01	8.20	100	8.33	158.	46.	110.	806.6
1.01	8.25	101	8.42	159.	47.	111.	806.7
1.01	8.30	102	8.50	159.	47.	112.	806.7
1.01	8.35	103	8.58	159.	47.	113.	806.8
1.01	8.40	104	8.67	160.	47.	114.	806.8
1.01	8.45	105	8.75	160.	47.	114.	806.9
1.01	8.50	106	8.83	160.	47.	115.	806.9
1.01	8.55	107	8.92	160.	47.	116.	807.0
1.01	9.00	108	9.00	161.	47.	117.	807.0
1.01	9.05	109	9.08	161.	47.	117.	807.1

1.01	9.10	110	9.17	161.	47.	118.	807.1
1.01	9.15	111	9.25	161.	47.	119.	807.2
1.01	9.20	112	9.33	161.	48.	120.	807.2
1.01	9.25	113	9.42	162.	50.	121.	807.3
1.01	9.30	114	9.50	162.	52.	121.	807.3
1.01	9.35	115	9.58	162.	53.	122.	807.4
1.01	9.40	116	9.67	162.	55.	123.	807.4
1.01	9.45	117	9.75	162.	57.	124.	807.5
1.01	9.50	118	9.83	162.	59.	124.	807.5
1.01	9.55	119	9.92	162.	63.	125.	807.6
1.01	10.00	120	10.00	163.	66.	126.	807.6
1.01	10.05	121	10.08	163.	70.	126.	807.7
1.01	10.10	122	10.17	163.	73.	127.	807.7
1.01	10.15	123	10.25	163.	76.	127.	807.7
1.01	10.20	124	10.33	163.	78.	128.	807.8
1.01	10.25	125	10.42	163.	81.	129.	807.8
1.01	10.30	126	10.50	163.	84.	129.	807.8
1.01	10.35	127	10.58	163.	87.	130.	807.9
1.01	10.40	128	10.67	163.	89.	130.	807.9
1.01	10.45	129	10.75	164.	91.	131.	807.9
1.01	10.50	130	10.83	164.	94.	131.	808.0
1.01	10.55	131	10.92	164.	96.	132.	808.0
1.01	11.00	132	11.00	164.	99.	132.	808.0
1.01	11.05	133	11.08	164.	101.	132.	808.0
1.01	11.10	134	11.17	164.	105.	133.	808.1
1.01	11.15	135	11.25	164.	109.	133.	808.1
1.01	11.20	136	11.33	164.	111.	134.	808.1
1.01	11.25	137	11.42	164.	113.	134.	808.1
1.01	11.30	138	11.50	164.	116.	134.	808.1
1.01	11.35	139	11.58	164.	119.	135.	808.2
1.01	11.40	140	11.67	164.	121.	135.	808.2
1.01	11.45	141	11.75	164.	123.	135.	808.2
1.01	11.50	142	11.83	164.	126.	135.	808.2
1.01	11.55	143	11.92	165.	130.	136.	808.2
1.01	12.00	144	12.00	165.	133.	136.	808.2
1.01	12.05	145	12.08	199.	137.	136.	808.[illegible]
1.01	12.10	146	12.17	284.	147.	137.	808.3
1.01	12.15	147	12.25	376.	156.	139.	808.4
1.01	12.20	148	12.33	433.	168.	140.	808.5
1.01	12.25	149	12.42	463.	213.	142.	808.6
1.01	12.30	150	12.50	478.	291.	143.	808.6
1.01	12.35	151	12.58	487.	362.	144.	808.7
1.01	12.40	152	12.67	491.	417.	145.	808.7
1.01	12.45	153	12.75	494.	450.	145.	808.8
1.01	12.50	154	12.83	495.	469.	145.	808.8
1.01	12.55	155	12.92	496.	481.	146.	808.8
1.01	13.00	156	13.00	497.	487.	146.	808.8
1.01	13.05	157	13.08	506.	493.	146.	808.8
1.01	13.10	158	13.17	533.	505.	146.	808.8
1.01	13.15	159	13.25	561.	525.	146.	808.8
1.01	13.20	160	13.33	578.	548.	146.	808.8
1.01	13.25	161	13.42	587.	566.	147.	808.8
1.01	13.30	162	13.50	592.	578.	147.	808.8
1.01	13.35	163	13.58	595.	585.	147.	808.8
1.01	13.40	164	13.67	596.	591.	147.	808.8
1.01	13.45	165	13.75	597.	594.	147.	808.8
1.01	13.50	166	13.83	598.	596.	147.	808.8
1.01	13.55	167	13.92	598.	597.	147.	808.8
1.01	14.00	168	14.00	598.	597.	147.	808.8
1.01	14.05	169	14.08	612.	601.	147.	808.8

1.01	14.10	170	14.17	662.	617.	147.	808.9
1.01	14.15	171	14.25	694.	646.	147.	808.9
1.01	14.20	172	14.33	720.	677.	148.	808.9
1.01	14.25	173	14.42	734.	702.	148.	809.9
1.01	14.30	174	14.50	741.	720.	148.	808.9
1.01	14.35	175	14.58	74[illegible].	732.	148.	808.9
1.01	14.40	176	14.67	747.	739.	148.	808.9
1.01	14.45	177	14.75	748.	743.	148.	808.9
1.01	14.50	178	14.83	748.	746.	148.	808.9
1.01	14.55	179	14.92	749.	747.	148.	808.9
1.01	15.00	180	15.00	749.	748.	149.	808.9
1.01	15.05	181	15.08	723.	742.	148.	808.9
1.01	15.10	182	15.17	684.	722.	148.	808.7
1.01	15.15	183	15.25	726.	714.	148.	808.9
1.01	15.20	184	15.33	842.	749.	148.	808.9
1.01	15.25	185	15.42	1040.	846.	149.	809.0
1.01	15.30	186	15.50	1460.	1051.	151.	809.1
1.01	15.35	187	15.58	2460.	1582.	156.	809.3
1.01	15.40	188	15.67	3517.	2495.	162.	809.7
1.01	15.45	189	15.75	3527.	3172.	167.	809.9
1.01	15.50	190	15.83	2841.	3180.	167.	809.9
1.01	15.55	191	15.92	2146.	2725.	164.	809.7
1.01	16.00	192	16.00	1640.	2179.	160.	809.5
1.01	16.05	193	16.08	1288.	1717.	157.	809.4
1.01	16.10	194	16.17	1042.	1362.	154.	809.2
1.01	16.15	195	16.25	886.	1137.	152.	809.1
1.01	16.20	196	16.33	797.	985.	151.	809.1
1.01	16.25	197	16.42	751.	879.	150.	809.0
1.01	16.30	198	16.50	725.	808.	149.	809.0
1.01	16.35	199	16.58	710.	762.	149.	808.9
1.01	16.40	200	16.67	705.	735.	148.	808.9
1.01	16.45	201	16.75	707.	719.	148.	808.9
1.01	16.50	202	16.83	701.	710.	148.	808.9
1.01	16.55	203	16.92	70[illegible].	705.	148.	808.9
1.01	17.00	204	17.00	70[illegible].	703.	148.	808.9
1.01	17.05	205	17.08	687.	698.	148.	808.9
1.01	17.10	206	17.17	646.	682.	148.	808.9
1.01	17.15	207	17.25	604.	653.	147.	808.9
1.01	17.20	208	17.33	576.	622.	147.	808.9
1.01	17.25	209	17.42	56[illegible].	596.	147.	808.8
1.01	17.30	210	17.50	558.	579.	147.	808.8
1.01	17.35	211	17.58	554.	567.	147.	808.8
1.01	17.40	212	17.67	552.	560.	146.	808.6
1.01	17.45	213	17.75	551.	555.	146.	808.8
1.01	17.50	214	17.83	551.	553.	146.	808.8
1.01	17.55	215	17.92	5[illegible]1.	552.	146.	808.8
1.01	18.00	216	18.00	550.	551.	146.	808.8
1.01	18.05	217	18.08	516.	539.	146.	808.6
1.01	18.10	218	18.17	37[illegible].	492.	146.	808.[illegible]
1.01	18.15	219	18.25	230.	407.	145.	808.7
1.01	18.20	220	18.33	147.	319.	144.	808.7
1.01	18.25	221	18.42	[illegible]	245.	142.	808.[illegible]
1.01	18.30	222	18.50	7[illegible].	207.	141.	808.[illegible]
1.01	18.35	223	18.58	63.	175.	141.	808.[illegible]
1.01	18.40	224	18.67	57.	166.	140.	808.[illegible]
1.01	18.45	225	18.75	53.	163.	139.	808.[illegible]
1.01	18.50	226	18.83	51.	157.	138.	808.[illegible]
1.01	18.55	227	18.92	50.	152.	138.	808.[illegible]
1.01	19.00	228	19.00	50.	147.	137.	808.[illegible]
1.01	19.05	229	19.08	50.	138.	136.	808.[illegible]

1.01	19.10	230	19.17	50.	160.	136.	808.2
1.01	19.15	231	19.25	50.	123.	135.	808.2
1.01	19.20	232	19.33	50.	119.	135.	808.2
1.01	19.25	233	19.42	50.	116.	134.	808.1
1.01	19.30	234	19.50	50.	113.	134.	808.1
1.01	19.35	235	19.58	50.	107.	133.	808.1
1.01	19.40	236	19.67	50.	106.	133.	808.1
1.01	19.45	237	19.75	50.	104.	133.	808.1
1.01	19.50	238	19.83	50.	101.	132.	808.0
1.01	19.55	239	19.92	50.	99.	132.	808.0
1.01	20.00	240	20.00	50.	[illegible]	132.	808.0
1.01	20.05	241	20.08	50.	95.	131.	808.0
1.01	20.10	242	20.17	50.	93.	131.	808.0
1.01	20.15	243	20.25	50.	92.	131.	807.9
1.01	20.20	244	20.33	50.	91.	131.	807.9
1.01	20.25	245	20.42	50.	89.	130.	807.9
1.01	20.30	246	20.50	50.	88.	130.	807.9
1.01	20.35	247	20.58	50.	87.	130.	807.9
1.01	20.40	248	20.67	50.	86.	130.	807.9
1.01	20.45	249	20.75	50.	85.	129.	807.8
1.01	20.50	250	20.83	50.	84.	[illegible]	807.8
1.01	20.55	251	20.92	50.	82.	129.	807.8
1.01	21.00	252	21.00	50.	81.	129.	807.8
1.01	21.05	253	21.08	50.	80.	128.	807.8
1.01	21.10	254	21.17	50.	79.	128.	807.8
1.01	21.15	255	21.25	50.	78.	128.	807.8
1.01	21.20	256	21.33	50.	77.	128.	807.8
1.01	21.25	257	21.42	50.	77.	129.	807.7
1.01	21.30	258	21.50	50.	76.	127.	807.7
1.01	21.35	259	21.58	50.	75.	127.	807.7
1.01	21.40	260	21.67	50.	74.	127.	807.7
1.01	21.45	261	21.75	50.	73.	127.	807.7
1.01	21.50	262	21.83	50.	72.	127.	807.7
1.01	21.55	263	21.92	50.	72.	127.	807.7
1.01	22.00	264	22.00	50.	71.	127.	807.7
1.01	22.05	265	22.08	50.	70.	[illegible]	807.7
1.01	22.10	266	22.17	50.	70.	126.	807.7
1.01	22.15	267	22.25	50.	69.	126.	807.6
1.01	22.20	268	22.33	50.	68.	126.	807.6
1.01	22.25	269	22.42	50.	68.	126.	807.6
1.01	22.30	270	22.50	50.	67.	126.	807.6
1.01	22.35	271	22.58	50.	67.	[illegible]	807.6
1.01	22.40	272	22.67	50.	66.	[illegible]	807.6
1.01	22.45	273	22.75	50.	65.	[illegible]	807.6
1.01	22.50	274	22.83	50.	65.	125.	807.6
1.01	22.55	275	22.92	50.	64.	[illegible]	807.6
1.01	23.00	276	23.00	50.	64.	125.	807.6
1.01	23.05	277	23.08	50.	63.	125.	807.6
1.01	23.10	278	23.17	50.	[illegible]	125.	807.5
1.01	23.15	279	23.25	50.	[illegible]	125.	807.6
1.01	23.20	280	23.33	50.	62.	125.	807.6
1.01	23.25	281	23.42	50.	62.	125.	807.6
1.01	23.30	282	23.50	50.	61.	125.	807.6
1.01	23.35	283	23.58	50.	61.	[illegible]	807.5
1.01	23.40	284	23.67	50.	61.	124.	807.5
1.01	23.45	285	23.75	50.	60.	124.	807.5
1.01	23.50	286	23.83	50.	60.	124.	807.5
1.01	23.55	287	23.92	50.	60.	124.	807.5
1.02	0.00	288	24.00	50.	59.	124.	807.5
1.02	[illegible]	289	24.08	46.	59.	124.	807.5

1.02	.10	290	24.17	32.	58.	124.	807.5
1.02	.15	291	24.25	184	57.	124.	807.5
1.02	.20	292	24.33	9.	56.	123.	807.5
1.02	.25	293	24.42	5.	56.	123.	807.5
1.02	.30	294	24.50	3.	55.	123.	807.4
1.02	.35	295	24.58	1.	54.	122.	807.4
1.02	.40	296	24.67	1.	53.	122.	807.4
1.02	.45	297	24.75	0.	53.	122.	807.4
1.02	.50	298	24.83	0.	52.	121.	807.3
1.02	.55	299	24.92	0.	51.	121.	807.3
1.02	1.00	300	25.00	0.	50.	121.	807.3

PEAK OUTFLOW IS 3186. AT TIME 15.33 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3180.	815.	245.	235.	70443.
CMS	90.	23.	7.	7.	1995.
INCHES		24.23	29.07	29.09	29.08
MM		615.52	738.32	738.56	738.56
AC-FT		404.	485.	485.	485.
THOUS CU M		499.	598.	598.	598.

....

SUMMARY OF PMF FLOOD ROUTING

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	804.45	804.00	808.30
STORAGE	83.	78.	191.
OUTFLOW	2.	0.	173.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	809.91	1.41	167.	3180.	6.25	19.83	0.00

HEC1DB ONE-HALF PMF INPUT DATA

```
************************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION   26 FEB 79
************************************
            A1                  DAM SAFETY INSPECTION - MISSOURI
            A2                    CARL DREYER DAM (MO.10158)
            A3                              50 PERCENT PMF
            B     300      0      5      0      0      0      0      0      0      0
            B1      5
            J       1      1      1
            J1     .5
            K       0  10158                                  1
            K1   INPUT RUNOFF PARAMETERS
            M       1      2   .313          .313      1                  1
            P            24.8    100    120   130
            T                                                -1    -93
            W2            .17
            X                             1
            K       1  10158                                  1
            K1   ROUTE HYDROGRAPH THROUGH CARL DREYER RESERVOIR
            Y                             1      1
            Y1      1                                       -804     -1
            Y4  804.0  805.7  806.0  806.3  807.0  807.2  807.5  808.0  808.2  808.3
            Y4  808.5  808.6  808.7  808.8  809.2  809.5  809.8  810.1  810.3  810.6
            Y5      0      8     29     46     47     47     57     97    123    148
            Y5    173    243    363    513   1253   2042   2873   3733   4600   5456
            $A             7     11     15     18     20     45
            $E    782    800    804  807.2  808.5    810    820
            $$    804
            $D  808.5
            A      99
```

INFLOW ONE-HALF PMF HYDROGRAPH

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	1315B
ROUTE HYDROGRAPH TO	1015B
END OF NETWORK	

```
**************************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
LAST MODIFICATION  26 FEB 79
**************************************

RUN DATE= 80/07/22.
    TIME= 0[illegible].11.43.

                    DAM SAFETY INSPECTION - MISSOURI
                      CARL DREYER DAM (MO.10158)
                           50 PERCENT PMF

                          JOB SPECIFICATION
    NQ    NHR   NMIN   IDAY   IHR   IMIN  METRC   IPLT   IPRT  NSTAN
   [illegible]     0      5      0     0      0      0      0      0      0
                      JOPER   NWT  LROPT  TRACE
                         5      0      0      0

                 MULTI-PLAN ANALYSES TO BE PERFORMED
                    NPLAN= 1 NRTIO= 1 LRTIO= 1
     RTIOS=   .50

   **********     **********     **********     **********     **********

                  SUB-AREA RUNOFF COMPUTATION

    INPUT RUNOFF PARAMETERS

         ISTAQ  ICOMP  IECON  ITAPE  JPLT  JPRT  INAME  ISTAGE  IAUTO
         10158     0      0      0     0     0     1      0       0

                          HYDROGRAPH DATA
  IHYDG  IUHG  TAREA   SNAP  TRSDA  TRSPC  RATIO  ISNOW  ISAME  LOCAL
     1     2    .31    0.00    .31   1.00  0.000     0      1      0

                            PRECIP DATA
        SPFE    PMS     R6     R12     R24     R48     R72     R96
        0.00  24.80  100.00  120.00  130.00   0.00    0.00    0.00

                             LOSS DATA
  LROPT  STRKR  DLTKR  RTIOL  ERAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP
     0   0.00   0.00   1.00   0.00   0.00   1.00   -1.00  -93.00  0.00   0.00

      CURVE NO = -93.00  WETNESS = -1.00  EFFECT CN = 93.00

                        UNIT HYDROGRAPH DATA
                     TC= 0.00     LAG= .17

                           RECESSION DATA
               STRTQ=  0.00   ORCSN=  0.00   RTIOR= 1.00

 UNIT HYDROGRAPH 12 END-OF-PERIOD ORDINATES, TC=  0.00 HOURS, LAG=  .17  VOL= 1.00
   [illegible]   [illegible]   [illegible]   [illegible]   212.   [illegible]   [illegible]   311   17.
```

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.	1.01	12.35	151	.21	.20	.00	487.
1.01	.10	2	.01	0.00	.01	0.	1.01	12.40	152	.21	.20	.00	[illegible]
1.01	.15	3	.01	0.00	.01	0.	1.01	12.45	153	.21	.20	.00	494.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.50	154	.21	.21	.00	495.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.55	155	.21	.21	.00	496.
1.01	.30	6	.01	0.00	.01	0.	1.01	13.00	156	.21	.21	.00	497.
1.01	.35	7	.01	0.00	.01	0.	1.01	13.05	157	.25	.25	.00	500.
1.01	.40	8	.01	0.00	.01	0.	1.01	13.10	158	.25	.25	.00	533.
1.01	.45	9	.01	0.00	.01	0.	1.01	13.15	159	.25	.25	.00	561.
1.01	.50	10	.01	0.00	.01	0.	1.01	13.20	160	.25	.25	.00	578.
1.01	.55	11	.01	.00	.01	0.	1.01	13.25	161	.25	.25	.00	587.
1.01	1.00	12	.01	.00	.01	0.	1.01	13.30	162	.25	.25	.00	592.
1.01	1.05	13	.01	.00	.01	0.	1.01	13.35	163	.25	.25	.00	595.
1.01	1.10	14	.01	.00	.01	1.	1.01	13.40	164	.25	.25	.00	596.
1.01	1.15	15	.01	.00	.01	2.	1.01	13.45	165	.25	.25	.00	597.
1.01	1.20	16	.01	.00	.01	3.	1.01	13.50	166	.25	.25	.00	598.
1.01	1.25	17	.01	.00	.01	4.	1.01	13.55	167	.25	.25	.00	598.
1.01	1.30	18	.01	.00	.01	5.	1.01	14.00	168	.25	.25	.00	598.
1.01	1.35	19	.01	.00	.01	6.	1.01	14.05	169	.31	.31	.00	612.
1.01	1.40	20	.01	.00	.01	6.	1.01	14.10	170	.31	.31	.00	652.
1.01	1.45	21	.01	.00	.01	7.	1.01	14.15	171	.31	.31	.00	694.
1.01	1.50	22	.01	.00	.01	8.	1.01	14.20	172	.31	.31	.00	720.
1.01	1.55	23	.01	.00	.01	9.	1.01	14.25	173	.31	.31	.00	734.
1.01	2.00	24	.01	.00	.01	10.	1.01	14.30	174	.31	.31	.00	741.
1.01	2.05	25	.01	.00	.01	10.	1.01	14.35	175	.31	.31	.00	745.
1.01	2.10	26	.01	.01	.01	11.	1.01	14.40	176	.31	.31	.00	747.
1.01	2.15	27	.01	.01	.01	12.	1.01	14.45	177	.31	.31	.00	748.
1.01	2.20	28	.01	.01	.01	12.	1.01	14.50	178	.31	.31	.00	748.
1.01	2.25	29	.01	.01	.01	13.	1.01	14.55	179	.31	.31	.00	[illegible]
1.01	2.30	30	.01	.01	.01	14.	1.01	15.00	180	.31	.31	.00	749.
1.01	2.35	31	.01	.01	.01	14.	1.01	15.05	181	.19	.19	.00	723.
1.01	2.40	32	.01	.01	.01	15.	1.01	15.10	182	.38	.38	.00	689.
1.01	2.45	33	.01	.01	.01	15.	1.01	15.15	183	.38	.38	.00	726.
1.01	2.50	34	.01	.01	.01	16.	1.01	15.20	184	.57	.56	.00	942.
1.01	2.55	35	.01	.01	.01	16.	1.01	15.25	185	.66	.66	.00	1040.
1.01	3.00	36	.01	.01	.01	17.	1.01	15.30	186	1.60	1.60	.00	1460.
1.01	3.05	37	.01	.01	.01	17.	1.01	15.35	187	2.64	2.64	.00	2460.
1.01	3.10	38	.01	.01	.01	17.	1.01	15.40	188	1.04	1.04	.00	3517.
1.01	3.15	39	.01	.01	.01	19.	1.01	15.45	189	.66	.66	.00	[illegible]
1.01	3.20	40	.01	.01	.01	18.	1.01	15.50	190	.67	.66	.00	[illegible]
1.01	3.25	41	.01	.01	.01	19.	1.01	15.55	191	.38	.38	.00	2146.
1.01	3.30	42	.01	.01	.01	19.	1.01	16.00	192	.38	.38	.00	1640.
1.01	3.35	43	.01	.01	.01	19.	1.01	16.05	193	.29	.29	.00	[illegible]
1.01	3.40	44	.01	.01	.01	20.	1.01	16.10	194	.29	.29	.00	[illegible]
1.01	[illegible]	45	.01	.01	.01	20.	1.01	16.15	195	.29	.29	.00	[illegible]
1.01	[illegible]	46	.01	.01	.01	20.	1.01	16.20	196	.29	.29	.00	797.
1.01	[illegible]	47	.01	.01	.01	20.	1.01	16.25	197	.29	.29	.00	751.
1.01	4.00	48	.01	.01	.00	21.	1.01	16.30	198	.29	.29	.00	725.
1.01	4.05	49	.01	.01	.00	21.	1.01	16.35	199	.29	.29	.00	710.
1.01	4.10	50	.01	.01	.00	21.	1.01	16.40	200	.29	.29	.00	705.
[illegible]	[illegible]	51	.01	.01	.00	22.	1.01	16.45	201	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	52	[illegible]	.01	.00	22.	1.01	16.50	202	.29	.29	[illegible]	[illegible]
1.01	[illegible]	53	[illegible]	.01	.00	22.	1.01	16.55	203	.29	[illegible]	[illegible]	[illegible]
1.01	4.30	54	.01	.01	.00	22.	1.01	17.00	204	.29	.29	.00	[illegible]
1.01	[illegible]	55	.01	.01	.00	23.	1.01	17.05	205	.23	.23	.00	[illegible]
1.01	[illegible]	56	.01	.01	.00	23.	1.01	17.10	206	.23	.23	[illegible]	[illegible]

1.01	4.45	57	.01	.01	.00	23.	1.01	17.15	207	.23	.23	.00	634.
1.01	4.50	58	.01	.01	.00	23.	1.01	17.20	208	.23	.23	.00	578.
1.01	4.55	59	.01	.01	.00	23.	1.01	17.25	209	.23	.23	.00	565.
1.01	5.00	60	.01	.01	.00	24.	1.01	17.30	210	.23	.23	.00	556.
1.01	5.05	61	.01	.01	.00	24.	1.01	17.35	211	.23	.23	.00	554.
1.01	5.10	62	.01	.01	.00	24.	1.01	17.40	212	.23	.23	.00	552.
1.01	5.15	63	.01	.01	.00	24.	1.01	17.45	213	.23	.23	.00	551.
1.01	5.20	64	.01	.01	.00	24.	1.01	17.50	214	.23	.23	.00	551.
1.01	5.25	65	.01	.01	.00	24.	1.01	17.55	215	.23	.23	.00	551.
1.01	5.30	66	.01	.01	.00	25.	1.01	18.00	216	.23	.23	.00	550.
1.01	5.35	67	.01	.01	.00	25.	1.01	18.05	217	.02	.02	.00	506.
1.01	5.40	68	.01	.01	.00	25.	1.01	18.10	218	.02	.02	.00	370.
1.01	5.45	69	.01	.01	.00	25.	1.01	18.15	219	.02	.02	.00	230.
1.01	5.50	70	.01	.01	.00	25.	1.01	18.20	220	.02	.02	.00	145.
1.01	5.55	71	.01	.01	.00	25.	1.01	18.25	221	.02	.02	.00	99.
1.01	6.00	72	.01	.01	.00	25.	1.01	18.30	222	.02	.02	.00	76.
1.01	6.05	73	.07	.05	.01	35.	1.01	18.35	223	.02	.02	.00	63.
1.01	6.10	74	.07	.06	.01	64.	1.01	18.40	224	.02	.02	.00	57.
1.01	6.15	75	.07	.06	.01	94.	1.01	18.45	225	.02	.02	.00	55.
1.01	6.20	76	.07	.06	.01	115.	1.01	18.50	226	.02	.02	.00	51.
1.01	6.25	77	.07	.06	.01	126.	1.01	18.55	227	.02	.02	.00	50.
1.01	6.30	78	.07	.06	.01	133.	1.01	19.00	228	.02	.02	.00	50.
1.01	6.35	79	.07	.06	.01	137.	1.01	19.05	229	.02	.02	.00	50.
1.01	6.40	80	.07	.06	.01	140.	1.01	19.10	230	.02	.02	.00	50.
1.01	6.45	81	.07	.06	.01	143.	1.01	19.15	231	.02	.02	.00	50.
1.01	6.50	82	.07	.06	.01	145.	1.01	19.20	232	.02	.02	.00	50.
1.01	6.55	83	.07	.06	.01	146.	1.01	19.25	233	.02	.02	.00	50.
1.01	7.00	86	.07	.06	.01	148.	1.01	19.30	234	.02	.02	.00	50.
1.01	7.05	[illegible]	.07	.06	.01	149.	1.01	19.35	235	.02	.02	.00	50.
1.01	7.10	[illegible]	.07	.06	.01	150.	1.01	19.40	236	.02	.02	.00	50.
1.01	7.15	87	.07	.06	.01	151.	1.01	19.45	237	.02	.02	.00	50.
1.01	7.20	[illegible]	.07	.06	.01	152.	1.01	19.50	238	.02	.02	.00	50.
1.01	7.25	[illegible]	.07	.06	.01	153.	1.01	19.55	239	.02	.02	.00	50.
1.01	7.30	[illegible]	.07	.06	.00	153.	1.01	20.00	240	.02	.02	.00	50.
1.01	7.35	[illegible]	.07	.06	.00	154.	1.01	20.05	241	.02	.02	.00	50.
1.01	7.40	[illegible]	.07	.06	.00	155.	1.01	20.10	242	.02	.02	.00	50.
1.01	7.45	93	.07	.06	.00	155.	1.01	20.15	243	.02	.02	.00	50.
1.01	7.50	94	.07	.06	.00	156.	1.01	20.20	244	.02	.02	.00	50.
1.01	7.55	95	.07	.06	.00	156.	1.01	20.25	245	.02	.02	.00	50.
1.01	8.00	96	.07	.07	.00	157.	1.01	20.30	246	.02	.02	.00	50.
1.01	8.05	97	.07	.07	.00	157.	1.01	20.35	247	.02	.02	.00	50.
1.01	8.10	98	.07	.07	.00	158.	1.01	20.40	248	.02	.02	.00	50.
1.01	8.15	99	.07	.07	.00	158.	1.01	20.45	249	.02	.02	.00	50.
1.01	8.20	100	.07	.07	.00	158.	1.01	20.50	250	.02	.02	.00	50.
1.01	8.25	101	.07	.07	.00	159.	1.01	20.55	251	.02	.02	.00	50.
1.01	8.30	102	.07	.07	.00	159.	1.01	21.00	252	.02	.02	.00	50.
1.01	8.35	103	.07	.07	.00	159.	1.01	21.05	253	.02	.02	.00	50.
1.01	8.40	104	.07	.07	.00	160.	1.01	21.10	254	.02	.02	.00	50.
1.01	8.45	105	.07	.07	.00	160.	1.01	21.15	255	.02	.02	.00	50.
1.01	8.50	106	.07	.07	.00	160.	1.01	21.20	256	.02	.02	.00	50.
1.01	8.55	107	.07	.07	.00	160.	1.01	21.25	257	.02	.02	.00	50.
1.01	9.00	108	.07	.07	.00	161.	1.01	21.30	258	.02	.02	.00	50.
1.01	9.05	109	.07	.07	.00	161.	1.01	21.35	259	.02	.02	.00	50.
1.01	9.10	110	.07	.07	.00	161.	1.01	21.40	260	.02	.02	.00	50.
1.01	9.15	111	.07	.07	.00	161.	1.01	21.45	261	.02	.02	.00	50.
1.01	9.20	112	.07	.07	.00	161.	1.01	21.50	262	.02	.02	.00	50.
1.01	9.25	113	.07	.07	.00	162.	1.01	21.55	263	.02	.02	.00	50.
1.01	9.30	114	.07	.07	.00	162.	1.01	22.00	264	.02	.02	.00	50.
1.01	9.35	115	.07	.07	.00	162.	1.01	22.05	265	.02	.02	.00	50.
1.01	9.40	116	.07	.07	.00	162.	1.01	22.10	266	.02	.02	.00	50.

1.01	9.45	117	.07	.07	.00	162.		1.01	22.15	267	.02	.02	.00	50.
1.01	9.50	118	.07	.07	.00	162.		1.01	22.20	268	.02	.02	.00	50.
1.01	9.55	119	.07	.07	.00	162.		1.01	22.25	269	.02	.02	.00	50.
1.01	10.00	120	.07	.07	.00	162.		1.01	22.30	270	.02	.02	.00	50.
1.01	10.05	121	.07	.07	.00	[illegible]		1.01	22.35	271	.02	.02	.00	50.
1.01	10.10	122	.07	.07	.00	163.		1.01	22.40	272	.02	.02	.00	50.
1.01	10.15	123	.07	.07	.00	163.		1.01	22.45	273	.02	.02	.00	50.
1.01	10.20	124	.07	.07	.00	163.		1.01	22.50	274	.02	.02	.00	50.
1.01	10.25	125	.07	.07	.00	163.		1.01	22.55	275	.02	.02	.00	50.
1.01	10.30	126	.07	.07	.00	163.		1.01	23.00	276	.02	.02	.00	50.
1.01	10.35	127	.07	.07	.00	163.		1.01	23.05	277	.02	.02	.00	50.
1.01	10.40	128	.07	.07	.00	163.		1.01	23.10	278	.02	.02	.00	50.
1.01	10.45	129	.07	.07	.00	164.		1.01	23.15	279	.02	.02	.00	50.
1.01	10.50	130	.07	.07	.00	164.		1.01	23.20	280	.02	.02	.00	50.
1.01	10.55	131	.07	.07	.00	164.		1.01	23.25	281	.02	.02	.00	50.
1.01	11.00	132	.07	.07	.00	164.		1.01	23.30	282	.02	.02	.00	50.
1.01	11.05	133	.07	.07	.00	164.		1.01	23.35	283	.02	.02	.00	50.
1.01	11.10	134	.07	.07	.00	164.		1.01	23.40	284	.02	.02	.00	50.
1.01	11.15	135	.07	.07	.00	164.		1.01	23.45	285	.02	.02	.00	50.
1.01	11.20	136	.07	.07	.00	164.		1.01	23.50	286	.02	.02	.00	50.
1.01	11.25	137	.07	.07	.00	164.		1.01	23.55	287	.02	.02	.00	50.
1.01	11.30	138	.07	.07	.00	164.		1.02	0.00	288	.02	.02	.00	50.
1.01	11.35	139	.07	.07	.00	164.		1.02	.05	289	0.00	0.00	0.00	46.
1.01	11.40	140	.07	.07	.00	164.		1.02	.10	290	0.00	0.00	0.00	32.
1.01	11.45	141	.07	.07	.00	164.		1.02	.15	291	0.00	0.00	0.00	18.
1.01	11.50	142	.07	.07	.00	164.		1.02	.20	292	0.00	0.00	0.00	9.
1.01	11.55	143	.07	.07	.00	165.		1.02	.25	293	0.00	0.00	0.00	5.
1.01	12.00	144	.07	.07	.00	165.		1.02	.30	294	0.00	0.00	0.00	3.
1.01	12.05	145	.21	.20	.00	194.		1.02	.35	295	0.00	0.00	0.00	1.
1.01	12.10	146	.21	.20	.00	284.		1.02	.40	296	0.00	0.00	0.00	1.
1.01	12.15	147	.21	.20	.00	376.		1.02	.45	297	0.00	0.00	0.00	0.
1.01	12.20	148	.21	.20	.00	432.		1.02	.50	298	0.00	0.00	0.00	0.
1.01	12.25	149	.21	.20	.00	463.		1.02	.55	299	.00	0.00	0.00	0.
1.01	12.30	150	.21	.20	.00	478.		1.02	1.00	300	.00	0.00	0.00	0.
										SUM	.24	31.35	.89	75956.
											(9.)	(796.)	(23.)	(2150.83)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3527.	820.	264.	257.	759[illegible]
CMS	100.	23.	7.	7.	21[illegible]
INCHES		24.81	31.35	31.35	31.[illegible]
MM		612.62	796.39	796.39	79[illegible]
AC-FT		409.	523.	523.	523.
THOUS CU M		504.	645.	645.	6[illegible]

HYDROGRAPH AT STA 1015R FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	1.	2.	[illegible]	3.	3.
4.	4.	4.	5.	5.	6.	6.	[illegible]	6.	7.
7.	7.	8.	8.	8.	8.	8.	[illegible]	9.	9.
9.	9.	10.	10.	10.	10.	10.	[illegible]	11.	11.
11.	11.	11.	11.	11.	11.	11.	[illegible]	12.	12.
12.	12.	12.	12.	12.	12.	12.	12.	13.	13.
13.	13.	18.	32.	47.	57.	63.	[illegible]	69.	70.
72.	72.	73.	74.	74.	75.	75.	76.	76.	77.
77.	77.	78.	78.	78.	78.	79.	79.	79.	79.
79.	80.	80.	80.	80.	80.	80.	80.	80.	81.

ONE-HALF PMF FLOOD ROUTING

1.	1.	[illegible]	[illegible]	81.	[illegible]	[illegible]	81.	81.	[illegible]
[illegible]	[illegible]	81.	82.	[illegible]	[illegible]	[illegible]	[illegible]	92.	[illegible]
[illegible]	82.	[illegible]	82.	[illegible]	62.	82.	82.	82.	82.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	18[illegible]	217.	[illegible]	239.
[illegible]	[illegible]	247.	[illegible]	248.	[illegible]	[illegible]	260.	[illegible]	289.
[illegible]	[illegible]	247.	296.	[illegible]	[illegible]	299.	299.	356.	326.
347.	[illegible]	[illegible]	37[illegible]	[illegible]	373.	374.	374.	374.	375.
[illegible]	[illegible]	363.	421.	[illegible]	730.	123[illegible]	17[illegible]	175[illegible]	1420.
107[illegible]	[illegible]	649.	[illegible]	495.	399.	37[illegible]	362.	355.	352.
351.	3[illegible]1.	35[illegible]	35[illegible]	345.	323.	302.	289.	283.	279.
277.	276.	276.	[illegible]	27[illegible]	27[illegible]	[illegible]	135.	11[illegible]	71.
[illegible]	[illegible]	[illegible]	28.	27.	26.	25.	[illegible]	25.	25.
[illegible]	25.	[illegible]	25.	[illegible]	[illegible]	[illegible]	25.	25.	25.
25.	25.	25.	25.	25.	25.	25.	25.	25.	25.
25.	[illegible]	[illegible]	25.	25.	25.	[illegible]	25.	25.	25.
25.	[illegible]	[illegible]	[illegible]	[illegible]	25.	[illegible]	25.	25.	25.
25.	[illegible]	25.	25.	[illegible]	[illegible]	[illegible]	[illegible]	25.	25.
[illegible]	[illegible]	25.	25.	25.	25.	25.	25.	23.	16.
[illegible]	5.	2.	1.	1.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1757.	421.	132.	127.	37979.
CMS	50.	12.	4.	[illegible]	1075.
INCHES		[illegible]	15.6[illegible]	15.66	15.6[illegible]
MM		11.21	[illegible]	398.20	[illegible]
AC-FT		204.	262.	262.	262.
THOUS CU M		252.	323.	323.	323.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH CAPE GREYER RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
16190	1	0	0	0		1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0			0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.0	-807.	-1

STAGE	804.00	805.70	806.00	806.30	807.00	807.2[illegible]	807.[illegible]	808.00	808.20
	808.50	808.60	808.70	808.80	809.[illegible]	[illegible]	809.80	810.10	810.[illegible]
FLOW	0.00	[illegible].00	29.0	46.01	47.00	47.0[illegible]	[illegible].00	97.00	183.00
	173.00	243.00	363.00	515.00	1253.00	2047.0[illegible]	2875.00	3733.00	4[illegible].00

SURFACE AREA=	[illegible]	7.	11.	15.	18.	20.	45.
CAPACITY=	0.	42.	78.	119.	141.	163.	466.
ELEVATION=	782.	800.	804.	807.	809.	811.	820.

CREL SPWID COQW EXPW ELEVL COQL CAREA EXPL

804.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
807.4	3.0	0.0	0.

STATION 13158, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

MO.DA	HR.MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1.01	.05	1	.08	0.	0.	78.	804.0
1.01	.10	2	.17	0.	0.	78.	804.0
1.01	.15	3	.25	0.	0.	78.	804.0
1.01	.20	4	.33	0.	0.	78.	804.0
1.01	.25	5	.42	0.	0.	78.	804.0
1.01	.30	6	.50	0.	0.	78.	804.0
1.01	.35	7	.58	0.	0.	78.	804.0
1.01	.40	8	.67	0.	0.	78.	804.0
1.01	.45	9	.75	0.	0.	78.	804.0
1.01	.50	10	.83	0.	0.	78.	804.0
1.01	.55	11	.92	0.	0.	78.	804.0
1.01	1.00	12	1.00	0.	0.	78.	804.0
1.01	1.05	13	1.08	0.	0.	78.	804.0
1.01	1.10	14	1.17	0.	0.	78.	804.0
1.01	1.15	15	1.25	1.	0.	78.	804.0
1.01	1.20	16	1.33	1.	0.	78.	804.0
1.01	1.25	17	1.42	2.	0.	78.	804.0
1.01	1.30	18	1.50	2.	0.	78.	804.0
1.01	1.35	19	1.58	3.	0.	78.	804.0
1.01	1.40	20	1.67	3.	0.	78.	804.0
1.01	1.45	21	1.75	4.	0.	78.	804.0
1.01	1.50	22	1.83	4.	0.	78.	804.0
1.01	1.55	23	1.92	4.	0.	78.	804.0
1.01	2.00	24	2.00	5.	0.	78.	804.0
1.01	2.05	25	2.08	5.	0.	78.	804.0
1.01	2.10	26	2.17	6.	0.	78.	804.0
1.01	2.15	27	2.25	6.	0.	78.	804.0
1.01	2.20	28	2.33	6.	0.	78.	804.0
1.01	2.25	29	2.42	6.	0.	78.	804.0
1.01	2.30	30	2.50	7.	0.	78.	804.0
1.01	2.35	31	2.58	7.	0.	78.	804.0
1.01	2.40	32	2.67	7.	0.	78.	804.0
1.01	2.45	33	2.75	8.	0.	78.	804.1
1.01	2.50	34	2.83	8.	0.	78.	804.1
1.01	2.55	35	2.92	8.	0.	78.	804.1
1.01	3.00	36	3.00	8.	0.	78.	804.1
1.01	3.05	37	3.08	8.	0.	78.	804.1
1.01	3.10	38	3.17	9.	0.	79.	804.1
1.01	3.15	39	3.25	9.	0.	79.	804.1
1.01	3.20	40	3.33	9.	0.	79.	804.1
1.01	3.25	41	3.42	9.	0.	79.	804.1
1.01	3.30	42	3.50	9.	0.	79.	804.1
1.01	3.35	43	3.58	10.	0.	79.	804.1
1.01	3.40	44	3.67	10.	1.	79.	804.1
1.01	3.45	45	3.75	10.	1.	79.	804.1
1.01	3.50	46	3.83	10.	1.	79.	804.1
1.01	3.55	47	3.92	10.	1.	79.	804.1
1.01	4.00	48	4.00	10.	1.	79.	804.1
1.01	4.05	49	4.08	11.	1.	79.	804.1

1.01	4.10	50	4.17	11.	1.	79.	804.1
1.01	4.15	51	4.25	11.	1.	79.	804.2
1.01	4.20	52	4.33	11.	1.	79.	804.2
1.01	4.25	53	4.42	11.	1.	80.	804.2
1.01	4.30	54	[illegible]	11.	1.	80.	804.2
1.01	4.35	55	4.58	11.	1.	80.	804.2
1.01	4.40	56	4.67	11.	1.	80.	804.2
1.01	4.45	57	4.75	11.	1.	80.	804.2
1.01	4.50	58	4.83	12.	1.	80.	804.2
1.01	4.55	59	4.92	12.	1.	80.	804.2
1.01	5.00	60	5.00	12.	1.	80.	804.2
1.01	5.05	61	5.08	12.	1.	80.	804.2
1.01	5.10	62	5.17	12.	1.	80.	804.2
1.01	5.15	63	5.25	12.	1.	80.	804.2
1.01	5.20	64	5.33	12.	1.	80.	804.2
1.01	5.25	65	5.42	12.	1.	80.	804.2
1.01	5.30	66	5.50	12.	1.	80.	804.2
1.01	5.35	67	5.58	12.	1.	81.	804.3
1.01	5.40	68	5.67	12.	1.	81.	804.3
1.01	5.45	69	5.75	12.	1.	81.	804.3
1.01	5.50	70	5.83	13.	1.	81.	804.3
1.01	5.55	71	5.92	15.	1.	81.	804.3
1.01	6.00	72	6.00	13.	1.	81.	804.3
1.01	6.05	73	6.08	[illegible]	1.	81.	804.3
1.01	6.10	74	6.17	32.	1.	81.	804.3
1.01	6.15	75	6.25	47.	2.	81.	804.3
1.01	6.20	76	6.33	57.	2.	82.	804.4
1.01	6.25	77	6.42	63.	2.	82.	804.4
1.01	6.30	78	6.50	68.	2.	83.	804.4
1.01	6.35	79	6.58	65.	2.	83.	804.5
1.01	6.40	80	6.67	70.	2.	84.	804.5
1.01	6.45	81	6.75	71.	3.	84.	804.6
1.01	6.50	82	6.83	72.	3.	84.	804.6
1.01	6.55	83	6.92	73.	3.	85.	804.6
1.01	7.00	84	7.00	74.	3.	85.	804.7
1.01	7.05	85	7.08	74.	3.	86.	804.7
1.01	7.10	86	7.17	75.	4.	86.	804.8
1.01	7.15	87	7.25	75.	4.	87.	804.8
1.01	7.20	88	7.33	76.	4.	87.	804.8
1.01	7.25	89	7.42	76.	4.	88.	804.9
1.01	7.30	90	7.50	77.	4.	88.	804.9
1.01	7.35	91	7.58	77.	5.	89.	805.0
1.01	7.40	92	7.67	77.	5.	89.	805.0
1.01	7.45	93	7.75	78.	5.	90.	805.0
1.01	7.50	94	7.83	78.	5.	90.	805.1
1.01	7.55	95	7.92	78.	5.	91.	805.1
1.01	8.00	96	8.00	78.	6.	91.	805.2
1.01	8.05	97	8.08	79.	6.	92.	805.2
1.01	8.10	98	8.17	79.	6.	92.	805.3
1.01	8.15	99	8.25	79.	6.	93.	805.3
1.01	8.20	100	8.33	79.	6.	93.	805.3
1.01	8.25	101	8.42	79.	6.	94.	805.4
1.01	8.30	102	8.50	80.	7.	94.	805.4
1.01	8.35	103	8.58	80.	7.	95.	805.4
1.01	8.40	104	8.67	80.	7.	95.	805.5
1.01	8.45	105	8.75	80.	7.	96.	805.5
1.01	8.50	106	8.83	80.	7.	96.	805.6
1.01	8.55	107	8.92	80.	8.	97.	805.6
1.01	9.00	108	9.00	80.	8.	97.	805.6
1.01	9.05	109	9.08	80.	8.	98.	805.7

1.01	9.10	110	9.17	81.	[illegible]	98.	805.[illegible]
1.01	9.15	111	9.25	81.	12.	99.	[illegible]05.8
1.01	9.20	112	9.33	81.	14.	99.	805.8
1.01	9.25	113	9.42	81.	17.	100.	805.8
1.01	9.30	114	9.50	81.	19.	100.	805.[illegible]
1.01	9.35	115	9.58	81.	21.	101.	805.9
1.01	9.40	116	9.67	81.	23.	101.	805.9
1.01	9.45	117	9.75	81.	25.	101.	805.9
1.01	9.50	118	9.83	81.	27.	102.	806.0
1.01	9.55	119	9.92	81.	[illegible]	102.	806.0
1.01	10.00	120	10.00	81.	31.	103.	[illegible]
1.01	10.05	121	10.08	81.	[illegible]	103.	806.1
1.01	10.10	122	10.17	81.	34.	103.	806.1
1.01	10.15	123	10.25	81.	[illegible]	104.	806.1
1.01	10.20	124	10.33	82.	36.	104.	806.2
1.01	10.25	125	10.42	82.	38.	104.	806.2
1.01	10.30	126	10.50	82.	39.	104.	806.2
1.01	10.35	127	10.58	82.	40.	105.	806.2
1.01	10.40	128	10.67	82.	41.	105.	806.[illegible]
1.01	10.45	129	10.75	82.	42.	105.	806.[illegible]
1.01	10.50	130	10.83	82.	43.	106.	806.3
1.01	10.55	131	10.92	[illegible]	44.	106.	806.[illegible]
1.01	11.00	132	11.00	82.	[illegible]	106.	[illegible]
1.01	11.05	133	11.08	82.	46.	[illegible]	806.[illegible]
1.01	11.10	134	11.17	82.	46.	107.	806.3
1.01	11.15	135	11.25	82.	46.	107.	806.3
1.01	11.20	136	11.33	82.	46.	107.	806.4
1.01	11.25	137	11.42	82.	46.	107.	806.[illegible]
1.01	11.30	138	11.50	82.	46.	108.	806.[illegible]
1.01	11.35	139	11.58	82.	46.	108.	806.4
1.01	11.40	140	11.67	82.	46.	108.	806.4
1.01	11.45	141	11.75	82.	46.	108.	806.[illegible]
1.01	11.50	142	11.83	82.	46.	109.	806.5
1.01	11.55	143	11.92	82.	46.	109.	[illegible]
1.01	12.00	144	12.00	82.	46.	109.	[illegible]
1.01	12.05	145	12.08	97.	46.	109.	[illegible]
1.01	12.10	146	12.17	142.	46.	110.	806.6
1.01	12.15	147	12.25	188.	46.	111.	[illegible]
1.01	12.20	148	12.33	217.	47.	112.	[illegible]
1.01	12.25	149	12.4[illegible]	231.	47.	113.	[illegible]
1.01	12.30	150	12.50	23[illegible].	47.	114.	[illegible]
1.01	12.35	151	12.58	243.	47.	116.	807.0
1.01	12.40	152	12.67	246.	47.	117.	807.1
1.01	12.45	153	12.75	247.	47.	119.	807.1
1.01	12.50	154	12.83	[illegible]	96.	120.	807.2
1.01	12.55	155	12.92	248.	[illegible]	121.	[illegible]
1.01	13.00	156	13.00	248.	54.	122.	807.4
1.01	13.05	157	13.08	253.	57.	124.	807.[illegible]
1.01	13.10	158	13.17	266.	64.	125.	[illegible]
1.01	13.15	159	13.25	280.	71.	127.	807.7
1.01	13.20	160	13.33	289.	78.	128.	807.9
1.01	13.25	161	13.42	294.	85.	129.	[illegible]
1.01	13.30	162	13.50	296.	[illegible]	131.	807.9
1.01	13.35	163	13.58	297.	100.	[illegible]	808.0
1.01	13.40	164	13.67	298.	110.	[illegible]	808.1
1.01	13.45	165	13.75	299.	120.	135.	808.2
1.01	13.50	166	13.83	299.	134.	136.	808.2
1.01	13.55	167	13.92	299.	149.	137.	808.3
1.01	14.00	168	14.00	300.	156.	138.	808.4
1.01	14.05	169	14.08	306.	163.	[illegible]	808.4

1.01	14.10	170	14.17	[illegible]	[illegible]	140.	808.5
1.01	14.15	171	14.25	347.	197.	141.	808.5
1.01	14.20	172	14.33	360.	234.	142.	808.6
1.01	14.25	173	14.42	367.	270.	143.	808.6
1.01	14.30	174	14.50	[illegible]	310.	143.	808.7
1.01	14.35	175	14.58	372.	332.	144.	808.7
1.01	14.40	176	14.67	373.	347.	144.	808.7
1.01	14.45	177	14.75	374.	[illegible]	144.	808.7
1.01	14.50	178	14.83	374.	363.	144.	808.7
1.01	14.55	179	14.92	374.	368.	144.	808.7
1.01	15.00	180	15.00	375.	371.	144.	808.7
1.01	15.05	181	15.08	361.	370.	144.	808.7
1.01	15.10	182	15.17	342.	362.	144.	808.7
1.01	15.15	183	15.25	363.	[illegible]	144.	808.7
1.01	15.20	184	15.33	421.	372.	144.	808.7
1.01	15.25	185	15.42	520.	415.	145.	808.7
1.01	15.30	186	15.50	735.	537.	146.	808.8
1.01	15.35	187	15.58	1230.	749.	148.	808.9
1.01	15.40	188	15.67	1718.	1123.	152.	809.1
1.01	15.45	189	15.75	1713.	1502.	155.	809.3
1.01	15.50	190	15.83	1820.	1557.	156.	[illegible]
1.01	15.55	191	15.92	1573.	1358.	154.	809.2
1.01	16.00	192	16.00	920.	1127.	152.	809.1
1.01	16.05	193	16.08	644.	937.	150.	809.0
1.01	16.10	194	16.17	521.	751.	148.	808.9
1.01	16.15	195	16.25	443.	617.	147.	808.9
1.01	16.20	196	16.33	399.	[illegible]	146.	808.8
1.01	16.25	197	16.42	376.	460.	145.	808.8
1.01	16.30	198	16.50	362.	421.	145.	808.7
1.01	16.35	199	16.58	355.	[illegible]	145.	808.7
1.01	16.40	200	16.67	352.	376.	144.	808.7
1.01	16.45	201	16.75	351.	366.	144.	808.7
1.01	16.50	202	16.83	351.	360.	144.	808.7
1.01	16.55	203	16.92	350.	[illegible]	144.	808.7
1.01	17.00	204	17.00	350.	354.	144.	808.7
1.01	17.05	205	17.08	343.	352.	144.	808.7
1.01	17.10	206	17.17	323.	345.	144.	808.7
1.01	17.15	207	17.25	302.	333.	144.	808.7
1.01	17.20	208	17.33	[illegible]	[illegible]	144.	808.7
1.01	17.25	209	17.42	283.	307.	143.	808.7
1.01	17.30	210	17.50	279.	[illegible]	143.	808.6
1.01	17.35	211	17.58	277.	291.	143.	808.6
1.01	17.40	212	17.67	276.	28?.	143.	808.6
1.01	17.45	213	17.75	276.	28?.	143.	808.6
1.01	17.50	214	17.83	275.	280.	143.	808.6
1.01	17.55	215	17.92	275.	27?.	143.	808.6
1.01	18.00	216	18.00	275.	277.	143.	808.6
1.01	18.05	217	18.08	263.	27?.	143.	808.6
1.01	18.10	218	18.17	16?.	25?.	143.	808.6
1.01	18.15	219	18.25	115.	22?.	142.	808.6
1.01	18.20	220	18.33	71.	[illegible]	141.	808.5
1.01	18.25	221	18.42	50.	171.	140.	808.5
1.01	18.30	222	18.50	38.	16?.	139.	808.4
1.01	18.35	223	18.58	32.	[illegible]	139.	808.4
1.01	18.40	224	18.67	28.	153.	138.	808.3
1.01	18.45	225	18.75	27.	145.	137.	808.3
1.01	18.50	226	18.83	26.	134.	136.	808.2
1.01	18.55	227	18.92	25.	124.	135.	808.2
1.01	19.00	228	19.00	25.	119.	135.	808.2
1.01	19.05	229	19.08	25.	114.	134.	808.1

1.01	19.10	230	19.17	25.	10[illegible].	1[illegible].	[illegible].1
1.01	19.15	231	19.25	25.	10[illegible].	133.	80[illegible].1
1.01	19.20	232	19.33	25.	101.	132.	808.0
1.01	19.[illegible]	233	19.42	25.	97.	132.	808.0
1.01	19.30	234	19.50	25.	95.	131.	808.0
1.01	19.35	235	19.58	25.	93.	131.	807.9
1.01	19.40	236	19.67	25.	91.	130.	807.9
1.01	19.45	237	19.75	25.	[illegible].	130.	807.9
1.01	19.50	238	19.83	25.	8[illegible].	120.	807.9
1.11	19.55	239	19.92	25.	[illegible].	129.	807.[illegible]
1.01	20.00	240	20.00	25.	82.	129.	807.8
1.01	20.05	241	20.08	25.	81.	128.	807.8
1.01	20.10	242	20.17	25.	[illegible].	128.	807.8
1.01	20.15	243	20.25	25.	77.	128.	807.8
1.01	20.20	244	20.33	25.	75.	127.	807.7
1.01	20.25	245	20.4[illegible]	25.	74.	127.	807.7
1.01	20.30	246	20.[illegible]	25.	72.	127.	807.7
1.01	20.35	247	20.[illegible]	25.	70.	126.	807.7
1.01	20.40	248	20.67	25.	69.	126.	807.6
1.01	20.45	249	20.75	25.	67.	126.	807.6
1.01	20.50	250	20.83	25.	66.	126.	807.6
1.01	20.55	251	20.92	25.	6[illegible].	125.	807.6
1.01	21.00	252	21.00	25.	63.	125.	807.6
1.01	21.05	253	21.08	25.	62.	125.	807.6
1.01	21.10	254	21.17	25.	61.	124.	807.5
1.01	21.15	255	21.25	25.	60.	124.	807.5
1.01	21.20	256	21.33	25.	5[illegible].	124.	807.5
1.01	21.25	257	21.42	25.	[illegible].	124.	807.5
1.01	21.30	258	21.50	25.	57.	124.	807.5
1.01	21.35	259	21.58	25.	56.	123.	807.5
1.01	21.40	260	21.67	25.	56.	123.	807.5
1.01	21.45	261	21.75	25.	55.	123.	807.4
1.01	21.50	262	21.83	25.	55.	123.	807.4
1.01	21.55	263	21.[illegible]	25.	54.	123.	807.4
1.01	22.00	264	22.00	25.	54.	122.	807.4
1.01	22.05	265	22.05	25.	54.	122.	807.4
1.01	22.10	266	22.17	25.	53.	122.	807.4
1.01	22.15	267	22.25	25.	53.	122.	807.4
1.01	22.20	268	22.33	25.	52.	122.	807.4
1.01	22.25	269	22.42	25.	52.	121.	807.3
1.01	22.30	270	22.50	25.	5[illegible].	121.	807.3
1.01	22.35	271	22.58	25.	51.	121.	807.3
1.01	22.40	272	22.67	25.	51.	121.	807.3
1.01	22.45	273	22.75	25.	50.	121.	807.3
1.01	22.50	274	22.83	25.	50.	120.	807.3
1.01	22.55	275	22.92	25.	50.	120.	807.3
1.01	23.00	276	23.00	25.	49.	120.	807.3
1.01	23.05	277	23.08	25.	49.	120.	807.3
1.01	23.10	278	23.17	25.	[illegible].	120.	807.2
1.01	23.15	279	23.25	25.	[illegible].	120.	807.2
1.01	23.20	280	23.33	25.	[illegible].	119.	807.2
1.01	23.25	281	23.42	25.	47.	119.	807.2
1.01	23.30	282	23.50	25.	47.	119.	807.2
1.01	23.35	283	23.58	25.	47.	119.	807.2
1.01	23.40	284	23.67	25.	47.	119.	807.2
1.01	23.45	285	23.75	25.	47.	119.	807.2
1.01	23.50	286	23.83	25.	47.	119.	807.2
1.01	23.55	287	23.92	25.	47.	118.	807.2
1.02	0.00	288	24.00	25.	47.	118.	807.1
1.02	[illegible].05	289	24.08	25.	47.	118.	807.1

1.02	.10	290	24.17	15.	47.	11[illegible].	[illegible]07.1
1.02	.15	291	24.2[illegible]	9.	47.	118.	807.1
1.02	.20	292	24.[illegible]3	5.	47.	117.	807.1
1.02	.25	29[illegible]	24.42	2.	47.	117.	807.1
1.02	.30	294	24.50	1.	47.	117.	807.0
1.02	.35	295	24.58	1.	47.	117.	807.0
1.02	.40	296	24.67	0.	47.	116.	807.0
1.02	.45	297	24.79	0.	47.	116.	807.0
1.02	.50	298	24.[illegible]	0.	47.	116.	807.0
1.02	.55	29[illegible]	24.[illegible]2	0.	47.	115.	806.9
1.02	1.00	[illegible]	2[illegible].[illegible]	0.	47.	115.	806.9

PEAK OUTFLOW IS [illegible]59. AT TIME 15.[illegible]3 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	15[illegible].	[illegible].	112.	103.	[illegible]06.
CMS	44.	2.	3.	3.	[illegible].
INCHES		10.[illegible]	1[illegible].46	13.4[illegible]	13.4[illegible]
MM		[illegible]	341.8[illegible]	341.8[illegible]	[illegible]41.8[illegible]
AC-FT		18[illegible].	[illegible].	225.	225.
THOUS CU M		224.	277.	277.	277.

....

SUMMARY OF ONE-HALF PMF FLOOD ROUTING

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN	RATIO 1 .50
HYDROGRAPH AT	1F15	.31	1	1763.
	(	.81)	(	49.92)(
ROUTED TO	1S1F	.31		1559.
	(	.81)	(	44.15)(

SUMMARY OF DAM SAFETY ANALYSIS

1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	[illegible]04.00	[illegible]04.00	[illegible]0[illegible].50
STORAGE	78.	78.	141.
OUTFLOW	0.	0.	173.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.[illegible]	[illegible]29.[illegible]2	.[illegible]	156.	1559.	4.17	15.83	0.00

PERCENT OF PMF FLOOD ROUTING
EQUAL TO SPILLWAY CAPACITY

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

```
RUNOFF HYDROGRAPH AT          1015A
ROUTE HYDROGRAPH TO           1016B
END OF NETWORK
```

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
LAST MODIFICATION  26 FEB 79
**********************************

RUN  DATE* 80/07/23.
     TIME* 08.50.11.

                    DAM SAFETY INSPECTION - MISSOURI
                     CARL DREYER DAM (MO.10158)
                            PERCENT PMF

                          JOB SPECIFICATION
      NQ    NHR   NMIN   IDAY    IHR   IMIN  METRC   IPLT   IPRT  NSTAN
     300      0      5      0      0      0      0      0     -4      0
                         JOPER    NWT  LROPT  TRACE
                             5      0      0      0

                  MULTI-PLAN ANALYSES TO BE PERFORMED
                      NPLAN= 1 NRTIO= 3 LRTIO= 1
         RTIOS=   .17   .18   .22

  **********   **********   **********   **********   **********

                   SUB-AREA RUNOFF COMPUTATION

  INPUT RUNOFF PARAMETERS

      ISTAQ  ICOMP  IECON  ITAPE   JPLT   JPRT  INAME  ISTAGE  IAUTO
      10156      0      0      0      0      0      1       0      0

                        HYDROGRAPH DATA
  IHYDG  IUHG  TAREA  SNAP  TRSDA  TRSPC  RATIO  ISNOW  ISAME  LOCAL
                 .31  0.00                 0.000

                           PRECIP DATA
        SPFE     PMS     R6     R12     R24    R48    R72    R96
        0.00   34.80  100.00  120.00  130.00

                            LOSS DATA
  LROPT  STRKR  DLTKR  RTIOL  ERAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP
                                                                0.00   0.00

                 EFFECT CN

                       UNIT HYDROGRAPH DATA
                           LAG=   .17

                           RECESSION DATA
                      QRCSN=   0.00

                      END-OF-PERIOD FLOW
  MO.DA  HR.MN  PERIOD  RAIN  EXCS  LOSS  COMP Q    MO.DA  HR.MN  PERIOD  RAIN  EXCS  LOSS  COMP Q
```

```
                                                             SUM   32.24   31.15    .89    75956.
                                                                 ( 819.)( 798.)(  23.)( 2150.88)

  **********        **********        **********        **********        **********

                              HYDROGRAPH ROUTING

                 ROUTE HYDROGRAPH THROUGH CARL OPEYER RESERVOIR

                   ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                   19158       1       0       0       0       0       1       0       0
                                         ROUTING DATA
            QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP            LSTP
              0.0   0.000    0.00       1       1       0       0               0

                   NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                       1       0       0   0.000   0.000   0.000   -804.      -1

  STAGE     804.00    805.71    806.00    806.30    807.00    807.20    807.50    808.00    808.20
            808.50    808.60    808.70    808.80    809.20    809.50    809.80    810.10    810.30

  FLOW        0.00      0.00     29.00     36.00     47.00     47.00     57.00     97.00    123.00
            113.00    243.00    363.00    513.00   1253.00   2040.00   2873.00   3735.00   4[illegible]

SURFACE AREA=      0.      7.      11.      15.      16.      20.      45.

  CAPACITY=       0.      42.      76.     115.     141.     169.     186.

  ELEVATION=     788.     800.     804.     807.     809.     810.     820.

                 CREL   SPWID    COQW    EXPW   ELEVL    COQL   CAREA    EXPL
                804.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

                                          DAM DATA
                                  TOPEL    COQD    EXPD   DAMWID
                                  808.5   [illegible]   [illegible]   [illegible]

PEAK OUTFLOW IS    1114. AT TIME  11.06 HOURS

PEAK OUTFLOW IS    1138. AT TIME  16.50 HOURS

PEAK OUTFLOW IS    3035. AT TIME  16.08 HOURS

  **********        **********        **********        **********        **********
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 .17	RATIO 2 .18	RATIO 3 .22
				RATIOS APPLIED TO FLOWS		
HYDROGRAPH AT	10159	.31	1	6??.	635.	776.
	(	.81)	(	16.58)(	17.99)(	21.97)(
ROUTED TO	101??	.31	1	114.	1??.	303.
	(	.81)	(	3.22)(	3.75)(	8.59)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	804.45	804.60	804.60
STORAGE	[illegible]	18.	141.
OUTFLOW	2.	0.	173.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.17	808.13	0.00	134.	119.	0.00	17.08	0.00
.18	808.24	0.00	136.	133.	0.00	16.50	0.00
.22	808.65	.15	143.	203.	1.00	16.08	0.00

HEC-2 INPUT AND SUMMARY TABLE

```
********************************************************
[illegible] RELEASE DATED NOV 76 UPDATED JULY 1978
[illegible] - C1.0 .03
[illegible] - [illegible]
********************************************************

T1        MISSOURI DAM SAFETY INSPECTION
T2        CARL DRYER DAM (MO.[illegible])
T3        [illegible] SPILLWAY RATING CURVE

J1  [illegible]  [illegible]  NINV   IDIF   STRT        METRIC  HVINI  [illegible]  WSEL     FQ
      -1.     2.          0.     0.  -1.000000    0.00    0.0     0.   807.70   0.00

J2  NPRUF  IPLOT  [illegible]  NSECV  NSECH  FN     ALLEL  ICW    CHNIM   ITRACE
      [illegible]  0.000  -1.000   0.000  6.000  0.000  0.000  0.000  0.000  0.000

    [illegible] SUMMARY PRINTOUT
    [illegible]  [illegible]  [illegible]  4.000  2[illegible]  10.000  43.000  3.000  5.000  17.000

    LP  [illegible]          *********REQUESTED SECTION NUMBERS*********

 [illegible]  -10.0[illegible]  0.[illegible]  [illegible]  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000
 [illegible]  14.00   16.[illegible]  50.000  75.000  100.000  125.000  150.000  175.000  200.000  300.000
 [illegible]  400.000  500.000  600.000  700.000  900.000  0.000  0.000  0.000  0.000  0.000

 [illegible]  1.00   4.000   0.000   [illegible]  0.000  0.000  0.000  0.000  0.400  0.000
 [illegible]  [illegible]  0.000  [illegible]  13.000  [illegible]  47.000  808.500  58.000  0.000  0.000

 [illegible]  2.000  0.000  0.000  0.000  50.000  50.000  30.000  0.000  [illegible]  0.000

 [illegible]  [illegible]  0.[illegible]  [illegible]  0.000  30.000  30.000  30.[illegible]  0.000  0.000  0.[illegible]
 [illegible]  [illegible]  [illegible]  [illegible]  0.000  0.000  0.000  0.000  0.000  0.000  0.[illegible]
```

****
HEC2 RELEASE DATED NOV 76 UPDATED JULY 1979
ERROR CORR - 01,02,03
MODIFICATION - 50,51,52,53
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

EMERGENCY SPILLWAY PATH

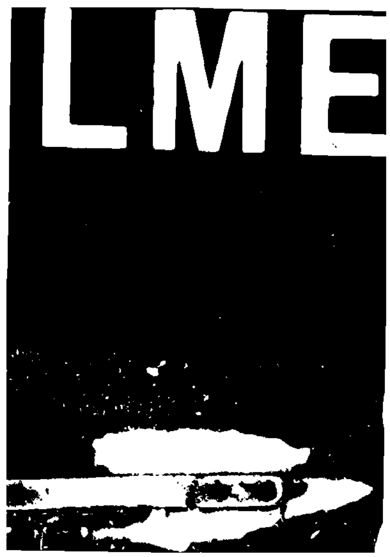
SUMMARY PRINTOUT

	SECNO	DEPTH	AREA	TOPWID	VCH	HV	Q	EG	10K*S	K*XNCH
*	1.000	.15	4.59	31.42	2.18	.07	10.00	807.23	209.31	27.00
*	1.000	.43	14.05	35.92	3.56	.20	51.00	807.43	146.08	27.00
*	1.000	.56	18.71	37.[illegible]	4.01	.25	75.00	807.61	131.49	27.00
*	1.000	.67	23.35	39.71	4.34	.29	100.00	807.76	125.60	27.00
*	1.000	.77	27.05	41.29	4.62	.33	125.00	807.90	124.29	27.00
*	1.000	.86	31.02	42.79	4.84	.36	150.00	808.07	118.97	27.00
*	1.000	.95	34.68	44.15	5.05	.40	175.00	808.14	116.36	27.00
*	1.000	1.13	38.18	45.29	5.24	.43	200.00	808.25	114.47	27.00
*	1.000	1.31	51.57	49.51	5.82	.53	300.00	808.61	107.14	27.00
*	1.000	1.54	63.17	51.53	6.33	.62	400.00	808.[illegible]	101.95	27.00
*	1.000	1.74	74.05	53.05	6.75	.71	500.00	809.25	97.13	27.00
*	1.000	1.94	84.48	54.54	7.10	.78	600.00	809.52	94.83	27.00
*	1.000	2.12	94.36	55.89	7.42	.85	700.00	809.77	92.59	27.00
*	1.000	2.29	104.07	57.17	7.69	.92	800.00	810.01	90.27	27.00
	2.000	.24	7.16	32.71	1.40	.03	10.00	807.47	48.78	27.00
	2.000	.57	18.73	37.93	2.67	.11	51.00	807.68	60.41	27.00
	2.000	.70	24.22	40.18	3.10	.15	75.00	808.05	62.32	27.00
	2.000	.82	29.09	42.07	3.44	.18	100.00	808.23	63.99	27.00
	2.000	.92	33.67	43.75	3.72	.21	125.00	808.34	65.04	27.00
	2.000	1.02	37.77	45.24	3.97	.24	150.00	808.46	66.46	27.00
	2.000	1.11	41.82	46.65	4.18	.27	175.00	808.58	67.16	27.00
	2.000	1.19	45.94	48.04	4.35	.29	200.00	808.68	66.67	27.00
	2.000	1.46	58.86	50.09	5.10	.41	300.00	809.07	71.25	27.00
	2.000	1.69	71.20	52.60	5.62	.49	400.00	809.38	70.74	27.00
	2.000	1.89	82.12	54.21	6.09	.55	500.00	809.[illegible]	71.73	27.00
	2.000	2.08	92.30	55.60	6.50	.66	600.00	809.93	72.67	27.00
	2.000	2.25	102.06	56.9[illegible]	6.86	.73	700.00	810.19	73.25	27.00
	2.000	2.41	111.24	58.00	7.19	.80	800.00	810.41	73.91	27.00

SECNO	DEPTH	AREA	TOPWID	VCH	HV	Q	EG	10K*S	K*XNCH
3.000	.53	15.39	34.2[illegible]	.65	.01	10.00	807.[illegible]4	15.01	27.00
3.000	.73	25.21	40.57	1.96	.06	50.00	807.79	24.57	27.00
3.000	.95	31.97	43.13	2.35	.09	75.00	808.17	27.28	27.00
3.000	1.02	37.90	45.29	2.54	.11	100.00	[illegible]	29.24	27.00
3.000	1.14	43.45	47.20	2.80	.13	125.00	809.47	30.64	27.00
3.000	1.25	49.63	48.32	3.08	.15	150.00	808.60	31.79	27.00
3.000	1.35	53.55	50.10	3.27	.17	175.00	808.71	32.45	27.00
3.000	1.45	57.90	51.75	3.45	.19	200.00	808.62	33.31	27.00
3.000	1.76	74.93	55.20	4.01	.25	300.00	809.21	34.22	27.00
3.000	2.01	88.55	55.10	4.52	.32	400.00	809.53	36.59	27.00
3.000	2.2[illegible]	101.75	[illegible].86	4.91	.37	500.00	809.82	37.71	27.00
3.000	2.46	114.21	58.00	5.25	.43	600.00	810.09	38.16	27.00
3.000	2.55	125.46	5[illegible].0[illegible]	5.55	.4[illegible]	700.00	810.34	38.31	27.00
3.000	2.63	1[illegible]5.92	58.[illegible]0	5.[illegible]9	.54	800.00	810.57	38.62	27.00

SUMMARY OF ERRORS

CAUTION SECNO= 1.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 2 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 3 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 4 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 5 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 6 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 7 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 8 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 9 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE=10 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE=11 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE=12 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE=13 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE=14 CRITICAL DEPTH ASSUMED


LME